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ANNOUNCEMENT

With this issue of Highway Safety Literature (HSL) we begin the announcement in the 900 000 series of training manuals prepared by the National Highway Traffic Safety Administration or various individual states and local communities in response to personnel training needs. These materials are part of NHTSA's Clearinghouse for Training materials; availability of items will be given in the individual citations.

HS-021 586

A PROFILE OF FATAL ACCIDENTS INVOLVING ALCOHOL*

by

James C. Fell

National Highway Traffic Safety Administration

ABSTRACT

Accident investigation research studies were conducted during 1971–75 in Boston, Baltimore, Oklahoma City, and Albuquerque, cities in which Alcohol Safety Action Programs (ASAPs) were operating. The specific objectives of the four studies varied somewhat, but certain common information concerning alcohol involvement and other factors was obtained in each investigation. Some of the more important findings from each of the individual studies include the following:

- BOSTON—39% of the most responsible drivers in fatal accidents had been drinking alcohol or had a combination of alcohol and other drugs in their systems just prior to the crash. An additional 9% of the responsible drivers admitted or were found to be under the influence of other intoxicating drugs such as marijuana, barbiturates, etc., without alcohol involvement. Significant overrepresentations of certain characteristics associated with alcohol-involved drivers as compared to a control group of drivers included previous citations for speeding or driving to endanger ($\geq$2), a suspended or revoked license, being separated or divorced, known alcohol-related job losses, frequency of alcohol intoxication, and a problem drinker diagnosis. A discriminant function analysis was used to develop a predictive formula for the identification of an alcohol-involved fatal accident driver.

- BALTIMORE—54% of the fatally injured drivers studied had a blood alcohol concentration (BAC) $\geq$0.05 mg% with a range of 0.05 mg% to 0.41 mg%. Of these alcohol-involved driver fatal accidents, 68% were single vehicle, 80% occurred between 8:00 p.m. and 4:00 a.m., 10% of the drivers had revoked licenses, 15% had previously been arrested for driving while intoxicated (DWI) or public intoxication, and 17% were separated or divorced. The study also indicated that male drivers most responsible for fatal or serious accidents regardless of their age or alcohol involvement displayed certain personality traits (belligerence, verbal expansiveness, impulsiveness, etc.) that were significantly different from the norm.

- OKLAHOMA CITY—The study of fatal accidents in Oklahoma City (with an ASAP) included a comparison group of fatal accidents in Tulsa (without an ASAP). Although the incidence of alcohol involvement in fatal accidents in both cities was not significantly different (Oklahoma City, 42%; Tulsa, 40%), the proportion of assessed "problem drinkers" in the Tulsa alcohol-involved fatal accidents was significantly higher than in the Oklahoma City alcohol-involved fatal accidents (Oklahoma City, 44%; Tulsa, 75%). An analysis of data from both cities showed overrepresentations of separated/divorced drivers, suspended/revoked licenses, alcohol use preferences and patterns, and previous alcohol-related arrests.

- ALBUQUERQUE—A sample of 220 alcohol-related crashes regardless of severity were studied. It was determined that 90% of these alcohol-involved drivers were considered responsible for the accident; they drove poorly maintained ve-

* Paper presented at the 21st Conference of the American Association for Automotive Medicine, Vancouver, British Columbia, September 15–17, 1977. Permission to reprint this paper from the *Proceedings* of this conference has been granted by the AAAM and the author.

hicles 5–7 years old; 20% had invalid licenses at the time of the crash; 56% had BACs $\geq$0.15 mg% when tested after the accident; 53% were considered to be problem drinkers; and almost 1 in 4 drivers admitted using other drugs at various times while drinking.

An analysis of all four studies, plus some newly available data on fatal crashes, revealed several salient characteristics of fatal accidents associated with alcohol:

Single-vehicle accidents are overrepresented, and in multiple-vehicle accidents the alcohol-involved vehicle is the striking vehicle. The accidents tend to occur between 8:00 p.m. and 4:00 a.m. on weekends and involve older model vehicles which are probably poorly maintained, and there is an increased risk that speeding or traveling too fast for conditions is involved.

An aggregate profile of the driver who typically was drinking and responsible for the crash shows him to be a male, 20–35 years of age, who has no more than a high school education, is single, separated or divorced, has an increased risk of having a previous DWI arrest, or two or more speeding violations, may have a suspended or revoked license at the time of the crash, and is a heavy social or problem drinker.

The findings suggest that the profile be utilized once the driver is brought into the system (for a DWI arrest or a second or third speeding violation) for further screening purposes and the appropriate countermeasure action.

BACKGROUND

In 1971 and 1972, the National Highway Traffic Safety Administration (NHTSA) began establishing a number of demonstration projects to attack the alcohol problem as related to highway safety. These Alcohol Safety Action Programs (ASAPs) [1]* were eventually established in 35 different communities (or in some cases entire states, e.g., New Hampshire and Idaho) in the United States and involved a multisystems approach to alcohol countermeasures. The basic concept was to surround the "problem drinker driver" with a set of countermeasures designed to identify him on the road, make decisions regarding remedial and rehabilitative procedures, and then take action to put these measures into effect. The ASAP demonstration projects provided federal funding to each of these communities in the areas of enforcement, prosecution, rehabilitation, and public information and education with the objective of demonstrating the feasibility of this systems approach and eventually catalyzing each state into action to improve their alcohol safety programs.

At the same time, the NHTSA was also sponsoring a number of accident research studies [2] involving the employment of Multidisciplinary Accident Investigation (MDAI) teams. These MDAI teams were located at universities and research centers in 14 different areas of the country, with four of them (Boston, Baltimore, Oklahoma City, and Albuquerque) in new ASAP areas. Thus, it became logical to use these four MDAI teams to provide accident research support to each of the local ASAPs. Individual accident studies were then designed involving NHTSA, ASAP, and MDAI personnel in order to (1) provide accident data support to the ASAPs, (2) develop a more accurate picture of the alcohol/accident problem in that community, (3) aid in better identifying the "problem drinker driver" most likely to become involved in an alcohol-involved crash, and (4) to some extent provide some information regarding the immediate impact of the ASAP in that community.

Each of the four accident studies had slightly different objectives and different experimental designs, according to local ASAP needs. The accident sampling procedures and the use of control groups (comparison data) were therefore different in each study. However, the studies were similar enough to initiate collection of some standardized data and to perform certain simple data analyses. Staff members of the Office of Statistics and Analysis, who managed the MDAI teams, decided to collect 41 important variables in each of the accident investigations and required the four teams to produce 14 standard data tables in their final reports [3]. Many of these variables produced similar results in each of the four studies and provided the salient characteristics of the profile described in this paper.

The purpose of this paper is threefold:

- to synopsize the important results of each of the four studies on an individual basis,
- to describe certain salient characteristics that were consistently produced in each of the studies and, consequently, develop a "profile" of fatal accidents involving alcohol, and
- to recommend a use for these data in future research and countermeasure efforts.

* Numbers in brackets [ ] indicate references listed at the end of the paper.

It should be stated at the outset what this paper is not. It does not describe studies of "accident proneness" in the classical sense. It also does not advocate "big brother" procedures such as using the information to screen licensing applicants and prevent drivers who fit the profile from obtaining a license. The information, at this point in time, should only be used as a secondary screening procedure once a driver has appeared in the "system" as a potential problem (e.g., arrested for driving while intoxicated and/or multiple arrests for speeding or driving to endanger).

Given this introduction and a few ground rules, a brief description of the study designs and methodologies is in order.

STUDY DESIGN, METHODOLOGY, AND DATA COLLECTION

As mentioned in the background, each study had different objectives and slightly different experimental designs according to local ASAP needs. However, certain common data elements were collected in each study, and the procedures for gathering the data were basically the same—interviews, driver records, blood alcohol concentrations, accident causal and driver responsibility assessments, and accident reconstruction by experienced professional investigators. Note that each study used a different control group to produce comparison data and yet some of the frequencies and overrepresentations (as shown in the results) are remarkably similar.

BOSTON

The basic objective of this three-year study conducted by Boston University was to collect and analyze relevant alcohol, drug, and human factors information on the most responsible drivers involved in 300 consecutive fatal accidents in metropolitan Boston. A subsequent control group of 801 "matched" nonaccident drivers was collected for comparison purposes. The basic instrument for collecting the data was a Human Factors Index (HFI) [4] which contained over 300 variables divided into the following eight categories: (1) Basic Demographic Data, (2) Psychosocial History, (3) Physical Health History, (4) Alcohol, Marijuana, and Other Drug Use Patterns, (5) Legal, Arrest, and Citation History, (6) Focal Accident Data, (7) Focal Human Factor Stress Scale, (8) Risk Taking Behavior Scale.

The experimental design can be synopsized as follows:

EXPERIMENTAL GROUP

- Drivers most responsible for fatal accidents as assessed by investigations using the police report, interview data, and accident reconstruction.
- Time period: September 1971–February 1974 (30 months).
- Sample selection: 306 consecutive fatal accidents (victim died within 24 hours) which occurred in greater Boston. 39 drivers subsequently eliminated from the analysis for the following reasons:
  - 20 had a fatal precrash heart attack (determined during autopsy),
  - 13 were hit-and-run accidents where the driver was not apprehended during the study period,
  - 6 involved no cooperation from any involved parties.
- 267 drivers finally analyzed.
- 300 variables from HFI collected on each driver.
- Between 2 and 23 interviews conducted in each case.

CONTROL GROUP

- Drivers never involved in a fatal accident and selected from the Boston population at large.
- Time period: January 1975–May 1975 (5 months).
- Sample selection: 801 licensed drivers never involved in a fatal accident and who lived in greater Boston. From 1,585 drivers originally contacted, the following 784 drivers were rejected:
  - 316 wrong address or could not be contacted,
  - 86 no valid drivers license,
  - 201 refused to cooperate,
  - 181 not needed due to matching criteria.
- Matching criteria:
  - (1) by residence: 4 community clusters matched
  - (2) by sex: 88% male (some as experimental)
  - (3) by age (same age distributions).
- Same variables (except focal accident data).
- One interview conducted with specific operator only.

BALTIMORE

This three-year study, which was conducted by the Maryland Medical Legal Foundation, had two basic objectives: (1) to determine any differences between drivers who were killed in accidents and a matched sample of drivers only moderately injured (AIS = 1–3) in similar accidents, and (2) to determine any significantly different psychosocial personality characteristics of drivers killed in accidents as measured by a set of norms. The basic instruments used were the Maryland Medical Legal Foundation Accident Investigation Psychosocial Questionnaire [5] and the Katz Adjustment Scale Behavior Inventory R-Forms [6].

The experimental design is depicted below:

EXPERIMENTAL GROUP

- Objective 1. 76 drivers who were fatally injured (within 24 hours) in a collision occurring in the greater Baltimore metropolitan area.
- Time period: June 1972–June 1975.
- Sample selection: Every driver killed in a traffic accident during that period.
- Instruments used: MMF Psychosocial Questionnaire (141 questions); Katz Adjustment Inventory (205 questions).
- Interviews with informants (family or friends of deceased driver).
- Objective 2. 137 fatally injured drivers—71 nonfatally injured male drivers.
- Combined data from 1968–1975.
- Same instruments.

CONTROL GROUP

- 79 drivers involved in nonfatal injury collision (AIS = 1–3) which were matched with the frontal collisions.
- Time period: same.
- Sample selection: Accidents "matched" with experimental group using following criteria:
  (1) same day of week
  (2) same hour of day
  (3) same type of collision (single or multiple)
  (4) same alcohol involvement (yes or no).

  The above were matched on a one-to-one basis one week after the fatal collision.
- Same instruments.
- Interview with driver himself and in some cases informants.
- Norms developed from the Katz Adjustment Scale Inventory R-Forms [6].

OKLAHOMA CITY

This was a one-year study conducted by the University of Oklahoma in an attempt to determine any alcohol-associated differences between fatal accidents in Oklahoma City and fatal accidents at a control site. The control site selected was the city of Tulsa, which was very similar to Oklahoma City in population and demographics, yet did not have an operational ASAP.

The collection instrument was very similar to the Boston University HFI as modified for local purposes by the University of Oklahoma MDAI team. A key member of the MDAI team was also a key member of the official ASAP Evaluation Project, which enhanced communication between the two groups.

The experimental design was as follows:

EXPERIMENTAL GROUP

- 59 drivers considered to be most responsible for the fatal accidents that occurred in Oklahoma City (ASAP).
- Sample selection: all fatal accidents where the victim died within 24 hours (no cases were dropped). An additional 14 fatal accidents occurred during the time period but the victims died after a 24-hour period.
- Time period: October 1973–October 1974 (12 months).
- Instrument used contained 110 data items [7].

CONTROL GROUP

- 30 drivers considered to be most responsible for the fatal accidents which occurred in Tulsa (non-ASAP).
- Sample selection: same criteria.
- Time period: December 1973–October 1974 (10 months).
- Same instrument.

ALBUQUERQUE

The purpose of this study was to provide an in-depth detailed analysis of alcohol-related crashes which occurred in Bernalillo County, New Mexico, where the ASAP was operating. The two-year effort was conducted by the University of New Mexico and differed from the other studies in that its primary focus was not fatal accidents, but alcohol-related accidents regardless of their severity. The alcohol-involved driver in these accidents was the focus of this study with the drivers who did not have alcohol involvement in these accidents serving as a control group (a form of "induced exposure"). Another control group that was used for comparison purposes was the drivers who were arrested for DWI and given in-depth psychosocial diagnosis by the Alcohol Treatment Program personnel in the ASAP.

The basic instrument was a 75-element questionnaire developed by the team with the approval of the NHTSA and the local ASAP people. The experimental design was somewhat unique and is depicted below:

EXPERIMENTAL GROUP

- 223 drivers with confirmed alcohol involvement in 220 crashes.
- Time period: July 1972–September 1974.
- Sample selection:
  - Level I—2,859 accidents in which the police reported some alcohol involvement during the study period. Used to describe alcohol-related accidents on the basic level and to select the 220 accidents for further study.
  - Level II—a subset of 220 accidents from Level I that generally involved an injury or a fatality (the more severe accidents) (13% property damage; 74% injury producing; 13% fatal).
  - Level III—a subset of 15 accidents from Level II in which in-depth analyses were made (four standard questionnaires given, etc.).
- Instruments used:
  - Level II—75-item psychosocial questionnaire [8].
  - Level III—Michigan Alcoholism Screening Test (MAST) [9]; Sansation Seeking Questionnaire [10]; Risk-Taking Questionnaire [11]; Wechsler Adult Intelligence Scale [12].

CONTROL GROUP

- 74 drivers with no alcohol involvement in the same 220 crashes.
- Time period: same.
- Sample selection:
  - Level I—the remaining 28,000 accidents which occurred during the study period without police-designated alcohol involvement.
  - Level II—the 74 drivers in the 220 accidents who did not have alcohol involvement. These were obviously the "other" drivers in multiple-vehicle accidents.
  - Level III—the 9 drivers in the 15 accidents without alcohol involvement.
- Instruments used: same.

RESULTS

The first part of this section will synopsize the important results from each of the four studies. The second part briefly presents some new data from a sample of 743 fatal accidents that were investigated by over 20 MDAI teams during the years from 1968–1976. These findings tend to verify many of the salient characteristics produced in the four original studies.

BOSTON

This was the most comprehensive of the four studies with respect to sample sizes, control group data, and the development of a profile based upon discriminant function analyses. The final report is actually in three volumes [4, 13, 14] with a wealth of information in each.

The final sample of 267 accidents included 38% where the "most responsible" driver was killed, 24%

where the most responsible driver survived but some other driver or occupant was killed, and the remaining 38% where a pedestrian was struck and killed. In the pedestrian cases it was later determined that the pedestrian was "most responsible" approximately 70–80% of the time. The driver, however, was still the focus of these cases and that must be kept in mind.

Of the studied collisions, it was found that 39% involved alcohol (most responsible driver had a BAC $\geq$0.05 mg% or a clinical evaluation thereof when no BAC was taken) or a combination of alcohol and other drugs. An additional 9% involved other intoxicating drugs such as marijuana, barbiturates, etc., without alcohol involvement. Therefore, 48% involved alcohol or some other intoxicating drugs. It is interesting to note that 16% of the drivers either admitted, or informants told the investigators, that they were under the influence of marijuana at the time of the crash. Over half of the marijuana-involved drivers had also been drinking alcohol.

No significant differences were found between the proportion of alcohol involvements in young and old drivers. That is, in the group of drivers aged 19 or less most responsible for a fatal accident, 37% involved alcohol as compared to 42% of the drivers between 20 and 29, and 40% of the drivers between 30 and 49 years of age.

Some important overrepresentations of certain characteristics are listed in Table 1. One can see the beginning of a profile in this table.

A discriminant function analysis was performed, with the accident-involved drivers divided into alcohol involved and not alcohol involved. The formula was then applied to the control drivers. The results are presented in Tables 2 and 3. The seven variables finally selected based upon their discriminating power included: (1) Alcohol Use Pattern, (2) Reported Frequency of Alcohol Drunkenness, (3) Number of Siblings, (4) Previous DWI Arrests, (5) Psychological Treatment History, (6) Occupation, and (7) Education. The implications of these findings and a recommendation for their use is discussed in the last section of this paper.

Finally, it should be noted that before ASAP operations began in Boston the alcohol involvement in the 101 fatal accidents occurring from September 1971 until January 1973 was 45%. During ASAP operations between January 1973 and February 1974 the alcohol involvement in 166 fatal accidents was 35%. This decrease was very close to being statistically significant and was certainly in the desired direction. Also, the drinking age in Massachusetts was lowered from 21 to 18 years of age in May 1973 during the ASAP operations. However, the alcohol involvement between that legal change and February 1974 was only 36%. There was no immediate expected rise in alcohol involvement.

TABLE 1. Characteristics Found in Drivers Responsible for Fatal Accidents in Boston and a Control Group of Drivers Not Involved in Fatal Accidents

	Drivers Responsible for Fatal Accidents (N=267)		Control Group of Drivers (N=801)
Characteristic	Alcohol Involved (%)	Non-Alcohol Involved (%)	(%)
Previous DWI Arrest(s)	9	2	2
Previous Citations for Speeding or Driving to Endanger $\geq$2	23	15	1
Invalid Drivers License (Suspended/Revoked)	9	1	1*
Marital Status Was Separated or Divorced	18	7	4
Known Alcohol-Related Job Loss	25	8	3
Frequency of Alcohol Use Weekly to Daily	51	29	38
Frequency of Alcohol Intoxication Weekly or Greater	40	12	9
Some Attempt to Drink Less	30	13	18
Diagnosed as Problem Drinker	63	25	19

* Five percent of the drivers contacted had either no license or it was suspended/revoked. The investigators estimated that about 1/5 of those people had a suspended or revoked license.

BALTIMORE

The findings for the first objective of this study were conspicuous by the absence of any meaningful differences between the fatally injured drivers and the matched control group of drivers in nonfatal collisions [15]. This most certainly had something to do with the matching criteria in the selection of the nonfatal

TABLE 2.* Summary Table for Discriminant Function Analysis Using Experimental Operators Involved in Non-Alcohol-Related Accidents and the Experimental Operators Involved in Alcohol-Related Accidents**

Step Number	Variable Entered	F To Enter	Sig. of Wilkes' Lambda	Sig. of Change in RAO'S V	Non-Alcohol Mean	Alcohol Mean
1	Alcohol use pattern	63.82567	0.001	0.001	1.4756	2.6408
2	Number of siblings	4.96623	0.001	0.013	3.5305	3.0971
3	Frequency drunkenness	5.56646	0.001	0.008	1.4695	2.8155
4	Psychological history	3.15201	0.001	0.042	0.2195	0.3010
5	DWI arrests	3.53313	0.001	0.030	0.0183	0.0874
6	Occupation	2.01383	0.001	0.099	4.3171	4.7282
7	Education	2.38000	0.001	0.071	3.9268	3.9612

Standard Discriminant Function Coefficients		Centroids of Groups	
	Function 1		Function 1
Alcohol use pattern	0.43350	Nonalcohol	–0.30538
Number of siblings	–0.19666		
Frequency drunkenness	0.29288	Alcohol	0.48337
Psychological history	–0.17308		
DWI arrests	0.16649		
Occupation	0.18746		
Education	–0.15893		

* Reproduced in entirety from [13].

** An alcohol-related accident was one where the focal operator had a blood alcohol concentration $\geq$0.05 g/100 ml% or a clinical evaluation of the same.

TABLE 3.* Prediction Results in Two-Way Discriminant Function Analysis Using the Experimental Operators Involved in Non-Alcohol-Related Accidents and the Experimental Operators Involved in Alcohol-Related Accidents With Controls as Unclassified Cases**

Actual Group Membership	Number of Operators	Predicted Group Membership: Group 1	Predicted Group Membership: Group 2
Group 1 (Non-Alcohol Accidents)	164	129 78.7%	35 21.3%
Group 2 (Alcohol Accidents)**	103	34 33.0%	69 67.0%
Unclassified Cases (Controls)	801	641 80.0%	160 20.0%

Percent of Grouped Cases Correctly Classified: 74.16%

* Reproduced in entirety from [13].

** An alcohol-related accident was one where the focal operator had a blood alcohol concentration $\geq$0.05 g/100 ml% or a clinical evaluation of the same.

crashes (same proportion of alcohol involvement; same proportion of single-vehicle accidents; same proportion of male drivers, etc.). However, it may also have been partially due to findings in the second part of the study—the personality characteristics of those drivers who are responsible for fatal and serious crashes.

In the 76 accidents involving a driver fatality it was found that 54% had a BAC $\geq$0.05 mg% with a range of 0.05 mg% to 0.41 mg%. Of the alcohol-involved driver fatal accidents, 68% were single-vehicle accidents, 80% occurred between 8:00 p.m. and 4:00 a.m., 10% of the drivers had revoked licenses, 15% had been previously arrested for DWI or public intoxication, 100% of them were considered culpable for the accident, and 17% of the drivers were separated or divorced. Due to the sample sizes, matching process, and other factors, none of the above percentages were significantly different for the 79 nonfatal collisions. The MDAI team concludes that driver fatal and driver serious injury accidents are not very different when comparing most responsible driver characteristics (see Table 4).

TABLE 4. Characteristics Found in Fatally Injured Most Responsible Drivers and Non-Fatally Injured Most Responsible Drivers in Accidents in Baltimore

	Fatally Injured Drivers (N=76)		Non-Fatally Injured Drivers (N=79)	
Characteristics	Alcohol Involved %	Non-Alcohol Involved %	Alcohol Involved %	Non-Alcohol Involved %
License Suspended or Revoked at Time of Crash	10	0	9	0
Previous Conviction for DWI	7	0	7	2
Marital Status Separated/Divorced	17	18	12	10
Place of Drinking Not in the Home	65	40	81	57
Problem Drinker	41	5	63	9
Education Less Than High School Graduate	55	29	54	33

In the second part of the study, all of the accident cases investigated by the team from the period 1968–1975 were pooled. Of these accidents, 137 male drivers had sufficient data for factor analysis of the MMF Psychosocial Questionnaire and 88 male drivers had sufficient data for factor analysis of the Katz Adjustment Scale (KAS). These cases were taken from 237 fatal driver accidents and only the "responsible male drivers" were analyzed. Some of the important findings are listed below:

- 25% of the married drivers were reported to have had recent marital difficulties due to alcohol.
- Over 50% of the drivers were said to either occasionally or frequently drink while driving and this percentage did not differ regardless of age or BAC at the time of the accident.
- 26% of the older drivers with alcohol involvement had previously been involved in accidents while they were under the influence of alcohol.
- 35% of the alcohol-involved older drivers were said to have been in trouble with the law as adults.
- 20% of the drivers had previous license suspensions.
- 45% of the drivers had one or more speeding convictions.

However, the most important finding of this second part of the analysis was that responsible male drivers (RMDs) in these accidents displayed certain personality traits that were significantly higher than a normative group tested on the KAS regardless of whether they were killed or injured in the accident, regardless of their age, regardless of their alcohol involvement at the time of the crash, and regardless of whether it was a single- or multiple-vehicle accident. A quote from the final report [5] summarizes this finding (p. 23):

> To begin, it seems to us that the evidence is altogether overwhelming that, on the whole, RMD's involved in fatal or potentially fatal auto-

mobile crashes are not representative of the general population of male drivers. Rather, they appear on the average to be characterized by a number of distinguishing features, usually, but not always, of an undesirable sort. They seem, for example, to be much more likely to drink while driving and to have a much greater incidence of alcohol-related problems than the male driving population at large. In addition, they appear to have a greater number of past traffic violations of all sorts, and previous arrests and/or convictions for unrelated illegal activities are not at all uncommon. Finally, independent assessments by relatives or friends describe them as being more belligerent, verbally expansive, impulsive, and extraverted than the general male population at large. All this should not be taken to mean that persons lacking these characteristics never have serious accidents. Indeed they do. However, the evidence seems virtually conclusive that males possessing these characteristics are disproportionately represented among drivers involved in serious automobile crashes, i.e., that male drivers possessing these characteristics are at a greatly increased risk of becoming automobile fatalities.

OKLAHOMA CITY vs. TULSA

Of the 59 fatal accidents (all types) investigated in Oklahoma City, 25 accidents (42%) involved alcohol [7]. This compares to 12 out of the 30 fatal accidents in Tulsa (40%), and these proportions were not significantly different. In fact, the only finding which pointed to any difference between the two cities as regards alcohol was that 44% of the alcohol-involved drivers in Oklahoma City were classified as "problem drinkers," while 75% of the alcohol-involved drivers in Tulsa were classified as such. These proportions were significantly different and could have been due in part to the ASAP. On the other hand, because of the large number of statistical tests performed this may have been a spurious result.

Other findings of interest are summarized in Table 5.

The profile drawn by the Oklahoma MDAI team of the alcohol-involved fatal crash is as follows:

- single-vehicle accident on a Friday night/Saturday morning
- between 8:00 p.m. and 4:00 a.m.
- involving an older vehicle (5–7 years old)
- coming from a tavern
- involving an unemployed married male with a high school education
- age 30–35
- problem drinker.

TABLE 5. Characteristics Found in Most Responsible Drivers in Fatal Accidents in Oklahoma City and Most Responsible Drivers in Fatal Accidents in Tulsa

Characteristics	Oklahoma City (N=59)		Tulsa (N=30)	
	Alcohol Involved (%)	Non-Alcohol Involved (%)	Alcohol Involved (%)	Non-Alcohol Involved (%)
Driver Marital Status Separated/Divorced	36	24	33	6
Problem Drinker	44	3	75	0
Preferred Drinking in Tavern	36	0	42	0
Preferred Beverage Is Beer	68	32	33	38
Frequency of Drinking Is Weekly or Greater	84	29	92	33
Transportation When Drinking—Drives Own Car	80	21	83	22
Alcohol-Related Marital, Social or Employment Problems	44	3	42	0
Previous Alcohol-Related Arrest	16	0	17	0
License Status: Suspended/Revoked	20	3	17	0

ALBUQUERQUE

The major results of the three levels of data will be summarized here as the final report [8] is voluminous (542 pages). In general, the Level I police data were useful in defining the accident descriptors on a statistical basis (N=2,859). It was found that 16% of all accidents reported in Bernalillo County involved alcohol as reported by the police. This is a higher

figure for general accident data than most other cities report. Two-thirds of these alcohol-involved crashes occurred at night on weekends. Single-vehicle, lone-driver, rollover, and fixed-object collision were all highly overrepresented in the alcohol crashes, when compared to all accidents reported to police. In multiple-vehicle accidents, the alcohol-involved vehicle was the striking vehicle over 75% of the time. For approximately 17% of the alcohol-related accidents involved, police reported speeds $\geq$60 mph. Alcohol-involved accidents involved higher incidences of injuries and fatalities than all accidents (see Table 6).

TABLE 6. Injury and Fatality Ratio Comparison Between Alcohol-Related Accidents and All Accidents in Bernalillo County—1973 [8]

	Alcohol-Related Accidents (N=2,859)	All Accidents (N=16,902)
Average Number of Persons Injured Per Accident	0.6153	0.4200
Average Number of Fatalities Per Accident	0.01294	0.00485

The Level II data of 220 severe alcohol-related accidents revealed the following information:

- Alcohol-involved drivers drove vehicles that were 5–6 years old on the average and that were poorly maintained (as measured by a vehicle condition index developed by the University of New Mexico team [8]).
- The alcohol-involved drivers were judged responsible for over 90% of the collisions (however, it should be remembered that 64% of the collisions were single vehicle).
- The alcohol-involved drivers were alone 70% of the time; if there were passengers they were usually other males who also had been drinking.
- 20% of the alcohol-involved drivers had invalid drivers licenses.
- 56% of the drivers had BACs $\geq$0.15 at the time of the accident.
- Almost 25% of the drivers admitted to sometimes using other drugs while drinking.
- 53% of these alcohol-involved drivers were diagnosed as "problem drinkers."

The Level III data, of course, contained very small sample sizes (15 alcohol-involved drivers; 9 non-alcohol-involved drivers) but an enormous amount of information on each driver (four standard questionnaires were administered to these drivers). Some interesting findings from this level were: 7 of 17 alcohol-involved vehicles had invalid or no vehicle inspection stickers; the average measured BAC of the driver was 0.19 mg%; the MAST [9] indicated that 7 of the 10 alcohol-involved drivers who took the test were problem drinkers (a local psychiatrist confirmed 5 of the 7); human error (comprehension and decision errors) were primarily responsible for 14 of the 15 accidents; 4 of the 15 cases involved multiple drug use.

Table 7 indicates some important percentages concerning alcohol-involved drivers as compared to non-alcohol-involved drivers in the same accidents (from the 220 Level II cases).

The profile of the alcohol-involved driver in Albuquerque was described as: male, between 25–30, Chicano or Indian, separated or divorced, laborer or unemployed, history of previous violations, suffering from some emotional stress, has a high BAC, and prefers beer.

TABLE 7. Characteristics Found in Alcohol-Involved Drivers and Non-Alcohol-Involved Drivers in 220 Collisions in Bernalillo County

Characteristics	Alcohol-Involved Drivers (%)	Non-Alcohol-Involved Drivers* (%)
Most Responsible for Crash	91	14
Marital Status Separated/Divorced	24	14
License Status:		
Suspended/Revoked	5	0
Expired	4	4
Never Issued	10	3
Frequency of Drinking Weekly or Greater	64	30
Problem Drinker	53	5
Previous Moving Violations $\geq$2	35	25

* Included only drivers with no alcohol involvement in the multiple-vehicle accidents. There were no non-alcohol-involved drivers in the single-vehicle accidents for obvious case selection reasons.

MDAI FATAL ACCIDENT FILE

A new accident data file has recently become available for analysis. The file is called the MDAI Fatal Factors File (FFF) [16] and it contains in-depth human factors and environmental information on over 1,000 fatal accidents investigated by various MDAI teams over the past 8 years. A total of 743 cases* were investigated by NHTSA-sponsored teams (the other cases were investigated by Canadian and Motor Vehicle Manufacturers Association teams), and these were analyzed to verify some of the findings described in this paper. Table 8 indicates some of the findings from this analysis.

It was found that 49% of the 743 accidents were alcohol involved (BAC $\geq$0.05 mg% or clinical evaluation thereof); 91% of the alcohol-involved drivers were male; 68% of the alcohol-involved accidents occurred between 8:00 p.m. and 4:00 a.m.; and 51% of the alcohol-involved drivers were between the ages of 20 and 35.

* NOTE: MDAI cases are not representative of the national picture. Some biases include the involvement of a late model passenger car, the fatality occurring with 24 hours, and cooperation in the investigation.

TABLE 8. Characteristics Found in Alcohol-Involved Drivers and Non-Alcohol-Involved Drivers in 743 MDAI Fatal Accidents Investigated by over 20 Teams During 1968–76

Characteristics	Alcohol-Involved Drivers (%)	Non-Alcohol-Involved Drivers (%)
Previous Alcohol-Related Arrest	38	6
Driver Speeding Prior to the Accident (over the speed limit or too fast for conditions)	71	31
Driver Most Responsible for Accident	93	50
License Status Suspended/Revoked	9	2
Previous Moving Violation $\geq$2	49	34
Marital Status Separated/Divorced	15	6

CONCLUSIONS AND IMPLICATIONS

In reviewing the frequencies, overrepresentations, factor analyses, and discriminant function analyses from these studies, it becomes obvious what the profile of a fatal accident involving a drinking driver is likely to be. There are just too many salient characteristics and overrepresentations of factors indicating high risk to be ignored. In summary, some of the accident characteristics are as follows:

- A single-vehicle accident, or if it is multiple vehicle, the alcohol-involved vehicle is the striking vehicle.
- Occurring between the hours of 8:00 p.m. and 4:00 a.m. on Friday or Saturday night.
- Involves an older model vehicle (5 to 8 years old) which is probably poorly maintained.
- Has an increased risk of involving speeds too fast for conditions or over the speed limit.

A profile of the driver who is at an increased risk involved in a fatal accident in which he was drinking and for which he was responsible is as follows:

- A male between the ages of 20 and 35 (with the means and modes hovering around 30).
- He has a high school education (or less) and there is a significant risk that he has a previous alcohol-related accident, DWI, or two or more speeding arrests.
- He may have a suspended or revoked license or had it suspended in the past.
- He is single, separated, or divorced, with the latter two categories indicating the highest risk.
- He tends to prefer beer to other alcoholic beverages and he is more likely a heavy social (drink weekly) or a problem drinker.
- He is driving with a BAC $\geq$0.10 mg% and an increased risk of it being $\geq$0.15 mg%.

How can these accident characteristics, and the driver profile in particular, be used by highway safety officials?

The Boston University team suggests the following approach based upon their data [13].

Three lines of variables, or three screens, could be used in a predictive high-risk driver formula based upon their discriminant function analysis. They suggest that it be used once the driver is in the system and has been recognized as a potential problem.

The first line screen would be as follows:

(1) the driver's first arrest for DWI or,

(2) the driver's second arrest for speeding or driving to endanger,

(3) the driver is male and between 19 and 39 years old.

If he fits, go to the second line:

(4) alcohol use patterns (problem drinker evaluation),

(5) frequency of alcohol drunkenness ($\geq$once per week),

(6) occupational attainment (low).

If he still fits, go to the third line:

(7) physical health history (fair to poor),

(8) psychological health history (problematical),

(9) education ($\leq$high school).

If he fits these screens then he should be identified for special rehabilitation, remedial action, or other associated countermeasures utilized in the Boston judicial systems.

The Maryland Medical Legal Foundation team discusses these findings in different terms [5]. It is worth quoting their final conclusions (p. 27):

> Design automobiles with sufficient safety features so as to preclude the possibility of serious injuries occurring. Although the economic cost of producing and owning such vehicles is likely to be high, it may still be lower overall than that associated with the current nationwide death and serious injury toll. The current regulatory trend toward the development of safer motor vehicles is certainly to be welcomed and encouraged.
>
> Provide better enforcement of existing traffic regulations and institute increased surveillance of persons identified as being at increased risk of serious accident. There is now ample evidence that drivers involved in fatal or serious crashes frequently have moderate to extensive records of previous legal (including traffic) violations. Since such persons have already identified themselves as being at increased risk, it would seem socially self-defeating not to make use of this information in an effort to promote the public safety. Better enforcement of existing traffic (not to mention other) laws and regulations would more validly identify the potentially serious traffic offender who could then be subjected to appropriate "probationary" procedures, perhaps including the posting of a sizable bond in order to be permitted to continue driving. Public acceptance of steps in this direction are already evident from the wide-spread utilization of the "point system" as an approach to curbing dangerous driving practices. What is essentially being recommended here is an extension and elaboration of the "point system" to include non-traffic offenses and the introduction of a "bond-posting" provision for persons at increased risk. The latter would seem necessitated by the fact that mere suspension or revocation of license does not invariably (or even usually) result in a cessation of all driving on the part of the person so penalized. The certainty of loss of a sizable amount of money already posted in the event of further violations should act as a powerful deterrent to their occurrence. Such reasoning is entirely consistent with currently popular theories regarding "performance contracting" in the realm of behavior modification.

It is recommended here that at least the following be considered:

(1) Concerning the accident profile characteristics described in the beginning of this section, police authorities should be made aware of these as to likely involvement of alcohol in an accident. Police authorities should be urged to utilize their state laws and encourage their police in the field to order alcohol tests on drivers involved in collisions fitting this mold. Alcohol-involved drivers must be detected in these accidents in order to be deterred from further drinking and driving, if indeed they survive the crash.

(2) Utilize the driver profile in a manner similar to the Boston suggestion. Start with a driver already in the system as a potential problem (a DWI arrest or his second or third speeding violation) and, before he is brought to trial, attempt some further screening (age, sex, marital status, alcohol use patterns, etc.), and assign him to certain remedial measures depending upon the outcome. At the very least, this information can be used by officials to educate these drivers and the public that they are at an increased risk of being responsible for a serious or fatal crash if they drink and drive.

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ABSTRACT CITATIONS

SAMPLE ENTRIES

FORMAT OF ENTRIES IN HIGHWAY SAFETY LITERATURE

NHTSA accession number ---------- HS-013 124

Title of document ---------- **MAXIMUM BRAKE PEDAL FORCES PRODUCED BY MALE AND FEMALE DRIVERS**

Abstract ---------- The object of this research was to obtain data concerning the maximum amount of brake pedal force that automobile drivers were able to sustain over a period of ten seconds. Subjects were told to apply the brakes in the test car as they would in a panic stop, and to exert as much force as possible on the pedal over the entire ten second test period. A total of 84 subjects were tested, including 42 males and 42 females. The results indicated that there is a wide distribution of values which characterizes the pedal force that the subjects were able to generate. Male subjects produced generally higher forces than did females. Over half the women tested were unable to exert more than 150 lbs. of force with either foot alone, but when both feet were applied to the pedal, force levels rose significantly.

Personal author(s) ---------- by C. R. VonBuseck
Corporate author (or author's affiliation) ---------- General Motors Corp.
Publication date; pagination ---------- 1973? ; 18p
Supplementary note ---------- Excerpts from Maximum Parking Brake Forces Applied by Male and Female Drivers (EM-23) BY R. L. Bierley, 1965, are included.
Availability ---------- Availability: Corporate author

NHTSA accession number ---------- HS-018 924

Title of document ---------- **NATURAL FREQUENCIES OF THE BIAS TIRE**

Abstract ---------- The lowest natural frequencies of a bias tire under inflation pressure are deduced by assuming the bias tire as a composite structure of a bias-laminated, toroidal membrane shell and rigorously taking three displacement components into consideration. The point collocation method is used to solve a derived system of differential equations with variable coefficients. It is found that the lowest natural frequencies calculated for two kinds of bias tire agree well with the corresponding experimental results in a wide range of inflation pressures. Results of the approximate analysis show that the influences of the in-plane inertia forces on natural frequency may be considered small, but the influences of in-plane displacements are large, particularly on the natural frequency of the tire under low inflation pressure.

Personal author(s) ---------- by Masami Hirano; Takashi Akasaka
Journal citation ---------- Publ: Tire Science and Technology v4 n2 p86-114 (May 1976)
Publication date ---------- 1976; 6refs
Availability ---------- Availability: See publication

HS-024 230

THE INFLUENCE OF GLARE ON THE DETECTION OF HAZARDOUS OBJECTS IN AUTOMOBILE NIGHT DRIVING

A description and analysis of an obstacle detection experiment under opposed glare light as part of a comprehensive research study of automobile headlighting are presented. This study is the natural continuation of unopposed headlighting experiments conducted previously. Several new factors are involved when an opposing headlight source is added to a target detection task and include interactive lighting, direct glare, and transient adaptation. A measurement methodology based on threshold values was incorporated; 50% threshold detection distances were obtained. The observer-driver drove the vehicle containing the test beams through a zone containing four retractable targets and an opposing headlamp system. A target in front of the opposing source involved the interaction of the two beams and the target appeared darker than the roadway throughout most of the detection zone. Two other targets were positioned next to the opposing lamp system so as to create detection tasks having varying glare levels. A fourth target was positioned behind the glare vehicle in order to facilitate the study of the phenomenon of transient decay. In view of the increased emphasis placed on the formulation of detection models to replace extensive field testing in automobile headlighting research, a significant portion of the present study was directed to the computation of the visibility of targets under opposing glare. Comparisons were made between the predictions of the detection model and those obtained from experimental target detection trials. It is concluded that, in order to specify the luminance distribution in the opposed glare encounter, it is necessary to quantify the foreground luminance distribution from the driving and opposing lamp sets, direct glare from the opposing lamps, target luminance, and roadway luminance in the vicinity of the target as caused by the driving and opposing lamp sets. Second, an accurate assessment of the detection potential under dynamic glare conditions is possible if the participant luminance difference and glare sensitivity are known, and the spatial and transient adaptation levels are established. This work has shown that one-to-one correspondence between field and laboratory visibility data is possible if sufficient precision can be applied to the description of existing field conditions in the presence of glare light.

by P. Huculak
National Res. Council Canada, National Aeronautical Establishment, Ottawa, Ont., Canada
Rept. No. NRC-16891; NAE-MER-MS-142; 1978; 39p 14refs
Includes French summary.
Availability: Corporate author

HS-024 231

TRANSPORTATION FOR THE HANDICAPPED. AN ANNOTATED BIBLIOGRAPHY OF THE HOLDINGS OF THE INSTITUTE OF TRANSPORTATION STUDIES LIBRARY, UNIVERSITY OF CALIFORNIA AT BERKELEY

This annotated bibliography of publications concerned with transportation for the handicapped is for the most part a representation of holdings at the Univ. of California at Berkeley's Inst. of Transportation Studies Library, but a few important works not currently in the Library are included. Few of the citations are for works published prior to 1970, reflecting the scant attention paid before that to the subject of transportation for the handicapped in the U.S. The belated interest of the 1970's has been spurred on by Federal and state legislation, as well as by disabled individuals themselves. The compilation is divided into the following broad subject headings: bibliographies, overviews/general works, theoretical works/models/technical studies, case studies (California, other states/regions), guidebooks, design considerations, and foreign sources. The sources consulted in the preparation of this bibliography are appended. For most publications, call numbers/shelving locations are included; generally, only the new, in-process publications lack such designations. Other abbreviations are provided which designate publications as numbered series (technical reports), as proceedings of conferences, in the pamphlet file, in the vertical file, as microfiche, in duplicate magazine article file, and as not currently in Library holdings.

by Daniel C. Krummes, comp.
University of California at Berkeley, Inst. of Transportation Studies, Berkeley, Calif.
Rept. No. UCB-ITS-LR-78-4; 1978; 30p 213refs
Availability: Corporate author

HS-024 232

DRIVER'S LICENSE LAW. REVISED ED. [NORTH CAROLINA]

Each section of the Uniform Driver's License Act as contained in Article II of General Statutes (G.S.) Chapter 20, state of North Carolina, is presented, as well as a few related statutes from other parts of G.S. Chapter 20. Each section is followed by commentary briefly summarizing the statute and citing relevant cases and opinions of the North Carolina Attorney General. An introductory chapter gives the history of driver licensing in the state, its purposes, etc. The introductory material concludes with a listing of the various types of licenses, permits, and certificates authorized by G.S. Chapter 20. A table, entitled Chart of Revocations and Points Assessed for Motor Vehicle Convictions, is also presented and denotes the effects of certain traffic offenses on a driver's license. While this publication was prepared primarily for use by the North Carolina Div. of Motor Vehicles, its contents should interest judges, district attorneys, lawyers, law enforcement officers, and others involved in enforcing and administering the North Carolina driver's license laws.

by Ben F. Loeb, Jr.
University of North Carolina at Chapel Hill, Inst. of Government
1978; 131p refs
Availability: Corporate author

HS-024 233

PLASTICS REFERENCE: PRIMER [GUIDE FOR THE AUTOMOTIVE INDUSTRY]

As an aid to the automotive engineer, the properties, automotive applications, and suppliers are outlined for the following categories of plastics: ABS (acrylonitrile-butadiene-styrene)

and SAN (styrene-acrylonitrile), engineering thermoplastics (acetal, fluoropolymers, polyimides, polyamide-imides, modified polyphenylene oxide, polyphenylene sulfide, thermoplastic polyester resin, nylon, polycarbonate, and polysulfone), thermosetting plastics (epoxy, phenolic, unsaturated polyester, urea and melamine, polyurethane foams, polyurethane products, polyols, isocyanates, etc.), polyvinyl chloride, miscellaneous resins (acrylics, thermoplastic elastomers), and silicones. A new advance in plastics technology is reported, a fundamental new approach to the manufacture of SMC (sheet-molding compound), Interpenetrating Thickening Process (ITP), patented by ICI Americas. The ITP involves the merger of urethane chemistry and technology with that of unsaturated polyester resins, and eliminates the use of alkaline earth oxides and hydroxides and their associated problems. Urethane chemistry is employed for maturation instead, resulting in the formation of polyurethane. For the future, the use of plastics in automobiles is expected to more than double per car by 1985 (400 lb/car); engineering thermoplastics and new formulations of SMC and BMC (bulk-molding compound) are expected to be the most widely used materials.

by Robert A. Wilson
Publ: Automotive Industries v158 n13 p31-7 (Sep 1978) 1978
Availability: See publication

HS-024 235

FUEL INJECTION CATCHES FIRE AT GM [GENERAL MOTORS]

Beginning with a few key 1980 General Motors (GM) cars, and extending through most 1981 models, the carburetor will be phased out and replaced by an electronic throttle body fuel injection (TBFI) system. The TBFI system has several advantages over the carburetor, but the one attribute that made GM decide on its use was repeatability, which is of utmost importance as automakers prepare to meet the 1981 Federal emission standards and as the government gets more involved with testing engine emission systems at the assembly plants. The Environmental Protection Agency's pressure to eliminate carburetor tampering by owners and garage mechanics also influenced GM. TBFI will provide improved driveability and slight gains in fuel economy and emissions, and it is a simple system, compared to most others designed to meet stringent government regulations. In addition, exhaust gas recirculation can be easily added to reduce oxides of nitrogen. TBFI is a somewhat simplified version of traditional fuel injection. GM also will combine it with the closed-loop, three-way emission system now being field tested on many production cars in California. Instead of electronically injecting the fuel into each cylinder, the fuel is atomized and precisely injected into the manifold by one or two injector units in a throttle body that vaguely resembles today's carburetor. The atomized fuel is then mixed with air rushing through a venturi in the throttle body and carried into the intake manifold where it is distributed conventionally to each cylinder. TBFI has eight major, and somewhat costly components: throttle body injection unit, electronic control module, twin-turbine fuel pump in the gas tank, fuel filter, inlet manifold air temperature sensor, inlet manifold pressure sensor, oxygen sensor in the exhaust line, and cooling temperature thermistor. A key feature of the system is that it senses oxygen and pollutants in the exhaust and signals an electronic control module as to what fuel settings should be used to produce the least hydrocarbons, carbon monoxide, and nitrogen oxides.

by Joseph M. Callahan
Publ: Automotive Industries v158 n13 p61-3 (Sep 1978) 1978
Availability: See publication

HS-024 236

ELECTRIC CARS. WHERE BATTERIES STAND

Although over 25 different types of electric-vehicle (EV) batteries have been proposed, only four appear to be strong practical contenders and they are the ind ustry staple: lead-acid, the touted nickel-zinc, the strongly contended, zinc-chloride, and the ultimate hope, sodium-sulfur. Steady advances have been made in lead-acid batteries, primarily the result of advances in electrode materials and processes, and new, thin separator materials. The Dept. of Energy (DOE) is sponsoring development of lead-acid batteries with specific energy goals of 40 Wh/kg and exhibiting long life. Nickel-zinc batteries have been under development for many years and soon will be commercially available. Cell capacities up to 850 Ah have been developed, and DOE is sponsoring development of nickel-zinc batteries of 20 kWh to 30 kWh capacity for electric vehicles. Specific energies of 70 Wh/kg have been demonstrated at a six-hr discharge rate, and near-term development goals are 90 Wh/kg. Cycle life is presently limited to less than 300 deep-discharge cycles. DOE and private funding sources are engaged in zinc-chloride battery development for EV applications. Batteries have been built in the 25-kWh size, and 100-kWh battery modules are being built. A specific energy of 77 Wh/kg has been achieved in a 50-kWh battery at a four-hr discharge rate; long-range specific energy goals are 110 Wh/kg. Another consideration in EV battery development is the concept of regenerative braking; tests have proven that regenerative braking (electrical braking in which kinetic energy is regenerated as electrical current and used to recharge battery) can deliver up to 15% of the battery energy used in start-stop driving. Allowing 5% battery energy for such functions as lights, instruments, and accessories, it is expected that a 10% energy savings will be realized in up to 10% longer battery life or will permit the use of smaller cells. An ongoing concern in EV battery use is recharging, and one area being explored at National Aeronautics and Space Administration is fast charging, a process by which an EV battery pack could be recharged at a service station in 20 min. Currently achievable, based on laboratory tests, is a 62% recharge in 70 min with 93% efficiency.

Publ: Automotive Industries v158 n13 p81-3 (Sep 1978) 1978
Availability: See publication

HS-024 237

TRUCKS: THE SOUND OF SILENCE [NOISE REGULATIONS]

Approaches by truck manufacturers to meet Environmental Protection Agency (EPA) noise regulations for medium-duty and heavy-duty interstate commercial trucks are described. Truck makers already have met EPA's 86 dB(A) and 83 dB(A) respective noise levels for 1975 and 1978 by way of cosmetic changes and generally little impact on vehicle design and costs. Compliance has been achieved by the use of double-wall ex-

haust pipes and dual double-wrapped mufflers, cooling fan clutch, engine compartment side shields, and absorption material. Manufacturers say vehicle costs will increase sharply by 1982 when truck makers double the use of noise abatement hardware to comply with the 80 dB(A) noise level. They actually plan to achieve 77 dB(A) to 78 dB(A) in order to ensure that all trucks meet compliance requirements. This level represents nearly an 80% drop in exterior noise, a level that approaches the development of the noiseless truck. Achievement of this noise level for trucks will be accomplished by use of double-wall vertical mufflers and double-wall exhaust pipes; full underpans (under the engine and transmission); absorption material inside the underpans, under the hood and side shields; modified engine with barrel-shaped, tight-clearance pistons; and cooling fan clutch. Major increases in new truck costs reflect d evelopment and testing of vehicle hardware, manufacturing and assembly costs, tooling, compliance testing and associated product assurance activity, and associated dealer and customer services which are provided by the manufacturer. In addition, maintenance costs will increase. For enforcement EPA uses production verification testing of initial representative products at the assembly line, statistical sampling and testing of new products at the assembly line, manufacturer's time-of-sale warranty, tampering prohibitions, maintenance instruction requirements, and administrative sanctions, including recall of noncomplying units. EPA has yet to cite a truck manufacturer for noncompliance of the noise standard, but there are guidelines for enforcement. Enforcers tally total truck noise which is comprised of exhaust, cooling fan, engine, air intake, and tire noise.

by John A. Stark
Publ: Automotive Industries v158 n13 p97-101 (Sep 1978) 1978
Availability: See publication

HS-024 239

THE REGULATION OF MOPEDS: A LEGISLATIVE PROPOSAL

Thirty-three states have already enacted some type of moped legislation and the remainder will probably pass similar laws within the next two years if the moped becomes as popular as estimates predict. Various legislative approaches to the moped and the apparent conflicts between jurisdictions are analyzed in order to present model legislation which will serve as a guide for states seeking to create or amend moped laws. The provisions recommended were developed with a view toward different geographical regions, and may be modified according to the needs of a particular jurisdiction. Predominantly rural states with comparatively small urban centers tend to regulate motor vehicles less than states with sprawling urban areas. As the rural regions become more urbanized and the concentration of motor vehicles increases, there tends to be a proportionately greater need to regulate motor vehicles and motor vehicle traffic. The article focuses on definitional conflicts and regulations, specifically those governing registration, certificate of title, licensing, age, insurance, speed, equipment, and inspection. Conclusions are that a moped clearly fits into the general category of motor vehicles and should be defined as such within state codes; the moped should be subject to all rules of the road applicable to other types of motor vehicles, and registration, licensing, age, certificate of title, speed limit, equipment, and inspection provisions applicable to other motor vehicles and operators should be amended to include mopeds. Insurance regulations should await further statistical analysis. All of the provisions proposed are supported in part by recommendations for moped regulation being considered for approval by the National Hwy. Traffic Safety Administration.

by Richard P. Weiss
Publ: New England Law Review v13 n2 p303-32 (Fall 1977) 1977; refs
Availability: See publication

HS-024 240

WHAT'S GOOD ABOUT DRIVER EDUCATION

Current encouraging developments in driver education programs for the U.S. public school system are described. Better programs now utilize effective, cognitive, and psychomotor activities and experiences in carefully integrated patterns. Courses are taught utilizing multi-media and small group work in the classroom, simulators to provide basic orientation and to develop visual skills and perceptions, off-street driving ranges to practice basic maneuvers and to learn the fundamentals of car control without an instructor always present, and finally, on-street, one-to-one instruction. Students move through the various phases as ability is demonstrated in each, instead of moving, lock-step, through a 36-hr course. The majority of school districts are moving toward the integration of safety into the curricula of grades K through 12 with at least a semester program in driver education. Driver education curricula ought to cover state laws and rules of the road; drugs and alcohol; bicycles and motorcycles in the traffic mix; elementary auto maintenance and repair; pedestrian rights and responsibilities; fuel economy and the environmental impact of the auto; the idea of no-accident driving; human capabilities and limitations; physical laws; how to drive in adverse conditions; skid protection and recovery; evasive maneuvers for emergencies; and understanding emotions and maximizing attention to driving. The Motorcycle Safety Foundation has developed a high-quality course of instruction on the safe use of the motorcycle, providing the visuals and the teacher's guides. Through the cooperation of local dealers, schools may obtain both cycles and helmets, without charge, for approved courses taught by certified instructors. Separate motorcycle curricula have been written in more than 25 states. Sixteen states have special teacher certification requirements for motorcycle instruction. Some 560 high school programs in safe motorcycle riding are being offered in 41 states; 22 colleges and universities are preparing teachers for this field. Individual programs in several states have centered around emergency evasive maneuver demonstrations for driver education teachers, development of advanced driver education courses, and the development of units in social studies for high school seniors that deal with youth involvement with the car. The National Hwy. Traffic Safety Administration sponsored studies to determine what constitutes a good driver education program. In DeKalb County, Ga., a five-year research project is under way to establish traffic safety education courses that are cost-beneficial, and to produce data that are valid, replicable, and usable.

by D. Paul Sondel
Publ: Traffic Safety v78 n9 p18-20, 28-31 (Sep 1978) 1978
Availability: See publication

HS-024 241

HOW BIG A PROBLEM IS FALSE IDENTITY? [DRIVER LICENSING]

The degree of false identification in driver licensing is not known, but indications are that millions of driver licenses have been issued in the U.S. in recent years to criminals under false identities, to illegal aliens presenting false records, and to numerous other persons for reasons of their own, such as for dividing their driving records among several identities to forestall license suspensions. Major progress toward improving the identification of drivers can be made through projects now underway. The Passport Office has provided the National Hwy. Traffic Safety Administration (NHTSA) with information and slides for incorporation into a training program for driver examiners to make easier the detection of false identification documents presented at the time of license application. A NHTSA-sponsored study by the American Assoc. of Motor Vehicle Administrators (AAMVA) will result in guidelines and recommendations for AAMVA's membership concerning the examination of documents presented for identification purposes in the driver licensing process. NHTSA is also working closely with AAMVA to develop and implement, at the state level, improved procedures in driver identification and license security. A special AAMVA ad hoc committee has been named to develop a model state driver licensing program. Color photographs on driver licenses, now in use in 45 states, provide a direct link between the license and the driver. A nationwide uniform numbering system is essential to assure reasonably accurate interstate driver identification, and, at the present time, the Social Security number (presently used by 30 states for driver record purposes) is the only numbering system that includes most drivers; this system should be adopted by all jurisdictions. NHTSA has committed itself to putting the NDR (National Driver Registry) on-line to meet the needs of the states.

by James Latchaw
National Hwy. Traffic Safety Administration, Office of Traffic Safety Programs, Washington, D.C. 20590
Publ: Traffic Safety v78 n9 p14-5 (Sep 1978)
1978
Reprinted from National Traffic Safety Newsletter published by National Hwy. Traffic Safety Administration.
Availability: See publication

HS-024 242

INSURANCE FLEET CUTS ACCIDENT RATE WITH DDC (DEFENSIVE DRIVING COURSE)

The State Automobile Mutual Insurance Co., Columbus, Ohio, examined the accident record of its fleet vehicles during 1970-1971 and found that the company was averaging over 123 accidents/year in operating 325 company cars, an accident rate of 15 accidents/million miles driven. The company decided to institute a safety program for all company car drivers, a program including notification to all fleet drivers that their past and future driving records would be maintained, mailing of monthly literature and dashboard safety stickers to each driver (although proposed this element was not carried out), placement of accident information packets in the glove compartment of each company auto to facilitate better reporting and accident analysis (most never used), and mandatory enrollment of all drivers in a driver improvement program, the National Safety Council's Defensive Driving Course (DDC). The DDC subsequently became the really effective part of the safety program. Soon after the program went into effect, it was cancelled; but by that time, 80% of the drivers had gone through the DDC. So today the measured effects of the program are related to the driving course. At present, the number of fleet accidents is 34.9% below the average accident rate prior to DDC, and is 56% below the peak accident rate of 1969. The company's accident rate has been cut from 14.81 accidents/million miles traveled in 1967 to 10.63 accidents/million miles traveled in 1975. The rate rose somewhat in 1977 to 11.37. The direct costs of State Auto's accidents for 1977 were almost exactly the same as direct costs in 1967. Considering the fact that auto repair costs have risen 120% since 1967, this is considered quite an accomplishment.

by G. Lincoln Sidwell
Publ: Traffic Safety v78 n9 p16-7 (Sep 1978)
1978
Availability: See publication

HS-024 243

TRUCKER'S SAFETY. PT. 2. STUDIES ON THE FREQUENCY OF ACCIDENTS FOR INDUSTRIAL TRUCKS, CARS AND PICK-UP TRUCKS, MOPEDS AND BICYCLES IN SOME LARGE INDUSTRIAL REGIONS (TRUCKARS SAKERHET. DEL 2. STUDIER AV OLYCKSFREKVENSEN FOR INDUSTRITRUCKAR, PERSON- OCH LASTBILAR, MOPEDER OCH CYKLAR INOM VISSA STORINDUSTRIOMRADEN) [SWEDEN]

Statistics are presented on the involvement of various types of vehicles in accidents in the working environment of five major Swedish industries (Sandvik A.B., Sandviken; Korsnas-Marma A.B., Gavle; Saab-Scania, Scaniadivisionen, Sodertalje; Uddeholms A.B., Stalrorelsen, Hagfors Jarnverk; and A.B. Volvo, Torslandaverken (VTV), Goteborg) during 1972-1973. The number of accidents and the hours of operation (exposure time) are tabulated for the following types of vehicles: forklift, sideloader, straddle carrier, pickup truck, private automobile, moped-bicycle, and other. The frequency of accidents has been separately calculated for each type of vehicle, for each industry and for the industries as a whole. The accident frequency has been defined as the number of accidents per 1000 hours of exposure. The data show that private automobiles and straddle carriers had an accident frequency above the mean value for all types of vehicles, that the accident frequency of forklifts was directly below the mean value, and that mopeds, bicycles, trucks, sideloaders, and other vehicle types had lower frequencies of accidents in that order. Thus, a 1972 report by the Motorredskapsutredningen (Motor Equipment Investigation) which classified forklifts and straddle carriers as the most accident-prone vehicles, could not be confirmed for the industries studied and in view of the limited nature of the research. Appended is a list of forty-six publications of the IVA Transport Res. Commission (TFK).

Ingenjorsvetenskapsakademien (IVA), Transportforskningskommissionen (TFK), Grev Turegatan 12, uppg. D, 1 tr., 114 46 Stockholm, Sweden
Rept. No. IVA-TFK-Utredningsrapport-46; 1975; 73p
Text also in Swedish. Research sponsored by Arbetarskyddsfonden.
Availability: Reference copy only

HS-024 244

MOPED ACCIDENTS INVOLVING PERSONAL INJURY FOR 1972. 15 TO 17-YEAR OLD DRIVERS (MOPEDOLYCKOR MED PERSONSKADA AR 1972. 15-17-ARIGA FORARE) [SWEDEN]

Data on injury accidents in Sweden involving moped drivers between the ages of 15 and 17 during 1972 show that there were 796 police-reported accidents in which 863 people were injured, including 27 who were killed. Urban areas accounted for 81.9% of the accidents, rural areas for 18.1%, with fatalities of 15 and 12, respectively. Slightly more than half of the accidents occurred during Jun-Sep; Fridays accounted for the largest number of accidents (17.1%) and Sundays the least (10.1%); approximately 2/3 of the accidents occurred between noon and 8:00 PM, and 3/4 occurred during daylight hours. Almost 3/4 of the accidents involved collisions between mopeds and motor vehicles, cars being most frequently implicated (62.7%). Accidents in which other motorists were not affected were the next most frequent type of accident (15.6%); these occurred more often on Saturday, on wet roadways, and during darkness than other accidents, and suspicion of driver DUI (driving under the influence of alcohol) was overrepresented in this group. The most common type of moped-motor vehicle accident was that at intersections (56.6%), followed by turning accidents (22.8%). Intersection accidents were also responsible for the most fatalities (11 accidents of 23). Head-on collisions were responsible for the most severe injuries, with 4 fatal and 15 severe-injury accidents out of a total of 40. Approximately 90% of the intersection accidents occurred in urban areas, the most common type involving a moped turning left and a motor vehicle on the right driving straight. The majority of turning accidents (83.3%) occurred inside urban areas, and 52.3% of the turning accidents involved opposing directions of travel. There were 42 moped-moped or moped-bicycle accidents (12 and 30, respectively), primarily at intersections. There were seven collisions between mopeds and track-bound vehicles, one streetcar and six train accidents; all had very severe consequences. The overwhelming majority of moped-pedestrian accidents (45 out of 49) occurred in urban areas, in most cases (34) involving a pedestrian crossing the road. Of the total of 813 moped riders involved, more than half (57.1%) were 15 years old, 31.3%% were 16 years old, and 11.6% were 17 years old; the majority were boys (91%). Moped riders accounted for 84.2% of all casualties, followed by pedestrians (5.9%), moped passengers (4.5%), and bicyclists (3.5%). The number of accidents per moped was almost three times as high in the metropolitan areas as in Norrland, and two and one-half times as high as in the rest of Sweden.

by Stig Alexandersson; Thomas Lekander; Hans Rydgren
Statens Trafiksakerhetsverk, Analyskontoret, Sweden
Rept. No. Stat.grp-PM-8; 1976; 128p 5refs
Text also in Swedish.
Availability: Reference copy only

HS-024 245

AERODYNAMIC DRAG MECHANISMS OF BLUFF BODIES AND ROAD VEHICLES. PROCEEDINGS OF A SYMPOSIUM (20TH) HELD AT GENERAL MOTORS RESEARCH LABORATORIES, WARREN, MICHIGAN, SEPTEMBER 27-28, 1976

A compilation is presented of papers and oral discussions from an international symposium whose primary objective was to explore the basic mechanisms by which aerodynamic drag is generated on bluff bodies. The configurations and flow fields of interest shared the following major characteristics: three-dimensional bodies (symmetric and asymmetric) with flow fields containing numerous regions of quasi-two-dimensional and three-dimensional flow separation both in front as well as in the rear, with discrete vortices in the wake, and a lift-to-drag ratio of about unity. Topics covered include the aerodynamic drag of cars (current understanding, problems and future), drag-related flow field characteristics of trucks and buses, effects of free-stream turbulence and the presence of the ground on the flow around bluff bodies, general characteristics and properties of three-dimensional flow fields, mechanisms of two- and three-dimensional base drag, drag-reducing techniques for axi-symmetric bluff bodies, effect of base slant on flow pattern and drag of three-dimensional bodies, recent Japanese research of three-dimensional bluff-body flows, interaction effects on the drag of bluff bodies in tandem, numerical modeling of blunt-body flows (problems and prospects), and prospects for numerical simulation of bluff-body aerodynamics. A list of symposium participants and a subject index are provided.

by Gino Sovran, ed.; Thomas Morel, ed.; William T. Mason, Jr., ed.
General Motors Res. Labs., Warren, Mich.
1978; 379p refs
Includes HS-024 246--HS-024 255.
Availability: Plenum Press, 227 W. 17th St., New York, N.Y. 10011 $39.50

HS-024 246

THE AERODYNAMIC DRAG OF CARS. CURRENT UNDERSTANDING, UNRESOLVED PROBLEMS, AND FUTURE PROSPECTS

An introduction to the drag-related aerodynamics of cars is presented from a practitioner's point of view. Both current understanding and unresolved problems are elucidated with the aid of examples from design work carried out on cars now on the road. A brief outline is given of the entire field of aerodynamics, of the economic significance of drag, and of the constraints that have to be observed during design. Aerodynamic drag is classified by type; the mechanisms of external and internal drag are discussed. Attention is drawn to gaps in related knowledge, especially to induced drag. A description is given of a method which has proved to be very effective during actual design work, the so-called optimization technique developed recently at Volkswagenwerk A.G., and results achieved with the technique are presented. The state of the art is placed in the context of a time history of vehicle aerodynamics. What has been achieved to date on production automobiles is compared with what is known to be attainable. It is concluded that great improvement can be gained in fuel economy when aerodynamic drag is reduced, not only for high-speed, steady-state cruise but also for representative driving cycles. In the latter case, a 15% reduction in fuel consumption can be achieved when the drag coefficient is reduced from 0.50 to 0.30. Within existing constraints and today's

knowledge, a figure of 0.30 is out of reach for cars designed under usual time and cost limitations.

by W.-H. Hucho
Volkswagenwerk A.G., Wolfsburg, Germany
Publ: HS-024 245, "Aerodynamic Drag Mechanisms of Bluff Bodies and Road Vehicles," New York, 1978 p7-44
1978; 27refs
Presented at symposium held in Warren, Mich., 27-28 Sep 1976. Includes discussion and editor's comment.
Availability: In HS-024 245

HS-024 247

THE DRAG RELATED FLOW FIELD CHARACTERISTICS OF TRUCKS AND BUSES

The results of wind-tunnel experiments with 1/7-scale tractor-trailer and bus models are used to identify major drag-producing regions of the flow fields, and to document some of the detailed characteristics. Some modifications of both the forebody and base flow fields are made in order to explore the practical potential for aerodynamic-drag reduction. The largest drag reductions are shown to be achievable by changing the forebody flow field. By controlling flow separation from leading edges, either by modifying body contours or by employing add-on devices, apparent minimum drag limits have been identified (drag coefficient of 0.6 for trucks, 0.4 for buses). The possibility of even lower drag levels within existing constraints is analyzed. The next generation minimum drag limits for trucks and buses are estimated to be 0.45 and 0.35, respectively, based on the following projections. For trucks, practical underbody modifications may lead to a reduction of 0.1, while a practical base modification may achieve 0.05. For buses, a combination of practical underbody and base modifications may produce a total 0.05 reduction. Non-zero yaw drag characteristics are briefly discussed. Over the normal operating range of gaps, tractor-trailers have the same yaw characteristics between zero and 10 degrees as gapless vehicles of similar length-to-diameter ratio, e.g. buses. This appears to be the result of the strong downflow through the gap of tractor-trailers which persists with increasing yaw angle and restricts the establishment of lateral flows. However, with a fairing-equipped tractor-trailer the relatively quiescent zero-yaw gap allows lateral flows to immediately develop through the gap with increasing yaw angle. This causes a departure in yaw characteristic away from that of gapless vehicles. It appears that when this lateral flow is blocked, the yaw characteristic is restored.

by W. T. Mason, Jr.; P. S. Beebe
General Motors Res. Labs., Warren, Mich.
Publ: HS-024 245, "Aerodynamic Drag Mechanisms of Bluff Bodies and Road Vehicles," New York, 1978 p45-93
1978; 21refs
Presented at symposium held in Warren, Mich., 27-28 Sep 1976. Includes discussion.
Availability: In HS-024 245

HS-024 248

SOME EFFECTS OF FREE-STREAM TURBULENCE AND THE PRESENCE OF THE GROUND ON THE FLOW AROUND BLUFF BODIES [AERODYNAMIC DRAG OF ROAD VEHICLES]

Certain aspects of aeronautical and building aerodynamics research are shown to be applicable to the study of the flow around road vehicles. Road vehicles are exposed to turbulence, generated both by the natural wind and by other vehicles, and, under some conditions, this may affect their mean drag characteristics. A review is given of the effects of turbulence on the drag of bluff bodies with separation from sharp edges, and with separation from continuous surfaces. It has been shown that free-stream turbulence can change separation and reattachment positions on bluff bodies by modifying boundary layer, free-shear layer, and wake development. Two-dimensional bluff bodies and bluff bodies with aspect ratios typical of road vehicles are equally affected. The influence of the ground plane on the flow around road vehicles is examined. Experimental results are presented of the forces acting on an idealized vehicle shape in "ground effect", demonstrating the importance of ground clearance. The results also expose differences between wind-tunnel experiments made with a moving wall and with a fixed ground plane. In any comparison between wind-tunnel and on-road data, atmospheric conditions should be considered. The flow about a road-vehicle-like body in a wind tunnel is best simulated by using a moving ground. A two-dimensional, free-streamline theory is used to predict, qualitatively, the experimental results. The free-streamline theory has shown that flow around bluff bodies near a ground plane can be predicted if the base pressure and separation position are known. Base pressure influences the lift by accelerating fluid in the gap between the underside of the vehicle and the ground. It is shown that a spoiler under the nose is a more aerodynamically efficient way of generating a force increment towards the ground than a spoiler above the trailing edge. This is because part of the effectiveness of the latter depends on reducing the base pressure.

by P. W. Bearman
Imperial Coll., London, England
Publ: HS-024 245, "Aerodynamic Drag Mechanisms of Bluff Bodies and Road Vehicles," New York, 1978 p95-127
1978; 28refs
Presented at symposium held in Warren, Mich., 27-28 Sep 1976. Includes prepared discussion by F. J. Buckley, Jr. (University of Maryland), and informal comment.
Availability: In HS-024 245

HS-024 249

MECHANISMS OF TWO AND THREE-DIMENSIONAL BASE DRAG [AERODYNAMICS OF BLUFF BODIES]

The mechanisms of the production of low pressure on the base of two-dimensional and axisymmetric bluff bodies are discussed. The factors which can influence this pressure are described, with emphasis on the effects of the presence of some three-dimensionality on basically two-dimensional base flows. The differences between two- and three-dimensional base flows are highlighted, first by discussing the effects of tip geometry on a high-aspect-ratio bluff-based body, and then by discussing a very simple three-dimensional bluff body. Some results are presented of an investigation into means of influencing the base pressure of this simple body, and the effect of the proximity of the ground is considered. It is stated that the flow around the base of a three-dimensional bluff body is not well understood, and that further work needs to be done before a conceptual model of the flow can be built. Small modifications to the base, and to the forebody, can produce useful changes in the base pressure, and a systematic investigation of these needs to be carried out. It is stated that the differences between two- and three-dimensional base flows

are great, and it is not necessarily true that a drag-reducing device which works in two-dimensional flow will achieve a similar result in three dimensions.

by D. J. Maull
Cambridge Univ., Cambridge, England
Publ: HS-024 245, "Aerodynamic Drag Mechanisms of Bluff Bodies and Road Vehicles," New York, 1978 p137-59
1978; 17refs
Presented at symposium held in Warren, Mich., 27-28 Sep 1976. Includes prepared discussion by E. Achenbach (Institut fur Reaktorbauelemente, Julich, Germany), and informal comments.
Availability: In HS-024 245

HS-024 250

DRAG-REDUCING TECHNIQUES FOR AXI-SYMMETRIC BLUFF BODIES [AERODYNAMICS]

The numerous experiments that have been made on aerodynamic-drag-reducing devices for two-dimensional bluff bodies have been used as a guide to indicate promising lines of investigation for axisymmetric bodies. For the latter case, experiments on splitter plates, cylindrical extensions, base bleed, and ventilated cavities are reviewed. Of these devices, base bleed is the only one that gives any useful reduction of drag. Unfortunately, base bleed cannot be effectively applied to road vehicles. The airflow rate available on a typical vehicle from its ventilation system is too small to give any significant effect. If a special air supply giving a larger airflow were to be provided, the intake momentum drag would be more than enough to counteract any drag reduction due to base bleed. For a blunt-based axisymmetric body, a boat-tailed afterbody is much more effective in reducing zero-yaw drag than any other device that has been tried. Furthermore, experiments have shown that as the yaw angle of a boat-tailed body is increased from zero, the axial force can decrease slightly up to a yaw angle of about 10 or 15 degrees, although at larger yaw angles it becomes much greater. The mode of action of a boat-tailed afterbody is explained, and some of the factors leading to a good design are discussed. The possibility of using boundary-layer control in conjunction with a boat-tailed afterbody is considered briefly. It is stated that a road vehicle must operate near the ground and cannot be axisymmetric, although cylindrical road tankers for carrying liquids are of some interest. Much more experimental work will be needed before it is possible to design with confidence a practicable vehicle with a rear end shaped to take advantage of the boat-tail principle.

by W. A. Mair
Cambridge Univ., Cambridge, England
Publ: HS-024 245, "Aerodynamic Drag Mechanisms of Bluff Bodies and Road Vehicles," New York, 1978 p161-87
1978; 23refs
Presented at symposium held in Warren, Mich., 27-28 Sep 1976. Includes prepared discussion by T. Morel (General Motors Res. Labs.), and informal comment.
Availability: In HS-024 245

HS-024 251

THE EFFECT OF BASE SLANT ON THE FLOW PATTERN AND DRAG OF THREE-DIMENSIONAL BODIES WITH BLUNT ENDS [AERODYNAMICS]

An experimental investigation is described which concerns the aerodynamic effects of slanting the blunt base of three-dimensional bodies having either an axisymmetric or a rectangular cross section. It was found that base slant can have a very dramatic effect on body drag, particularly in a relatively narrow range of slant angles where the drag coefficient exhibits a large local maximum (overshoot). Detailed study of the airflow showed that the drag maximum is related to the existence of two very different separation patterns at the rear of either body. One pattern is similar to that found behind axisymmetric bodies with no base slant, and its main feature is the presence of a closed separation region adjacent to the base. The other pattern is highly three-dimensional with two streamwise vortices approximately parallel to the slanted surface, one at each side of the body. The drag coefficient maximum occurs in the slant-angle range where a changeover from one flow pattern to the other takes place. The observed phenomenon may be thought of as being associated with a broader category of "critical geometries", which is tentatively defined and discussed.

by T. Morel
General Motors Res. Labs., Warren, Mich.
Publ: HS-024 245, "Aerodynamic Drag Mechanisms of Bluff Bodies and Road Vehicles," New York, 1978 p191-226
1978; 12refs
Presented at symposium held in Warren, Mich., 27-28 Sep 1976. Includes prepared discussion by J. E. Hackett (Lockheed-Georgia Co.), and informal comment.
Availability: In HS-024 245

HS-024 252

RECENT JAPANESE RESEARCH ON THREE-DIMENSIONAL BLUFF-BODY FLOWS RELEVANT TO ROAD-VEHICLE AERODYNAMICS

Following a brief discussion of recent Japanese research on automobile aerodynamics, and prospects for aerodynamics in the design of cars in Japan, results are presented for a study of bluff bodies relevant to truck and bus aerodynamics. The bluff-body study involved three-dimensional single-body configurations, bars of square cross section having length-to-width ratios (L/W) from virtually 0 to 5. All edges of the bars were sharp, the longitudinal axis of each was aligned in the flow direction, and testing was performed in the absence of a ground plane. The drag coefficient changed considerably as L/W was varied from 0 to 5. The character of the variation of drag coefficient with angle of incidence, as well as that of lift coefficient with incidence, changed drastically when L/W reached 1.6. For bars of L/W less than 1.2, the drag coefficient remained fairly constant throughout the angle of incidence range; on bars of L/W more than 1.6, the drag coefficient increased parabolically as angle of incidence increased. Flow visualization showed that this was accompanied by a change in the flow pattern, just as in the two-dimensional case of rectangular bars aligned perpendicular to flow direction, the subject of previous research. Also reported are results of a preliminary experiment on two-body configurations representative of tractor-trailer systems. In this case, the bodies were in tandem, each having its axis aligned in the streamwise direction, and the configuration was in close proximity to a simulated ground plane. The shape of the forebody and the rear of the afterbody were changed, while the gap and after-

body length were varied. Only drag data at zero yaw angle are presented for these configurations.

by H. Nakaguchi
University of Tokyo, Japan
Publ: HS-024 245, "Aerodynamic Drag Mechanisms of Bluff Bodies and Road Vehicles," New York, 1978 p227-52
1978; 20refs
Presented at symposium held in Warren, Mich., 27-28 Sep 1976. Includes discussion and editor's comment.
Availability: In HS-024 245

HS-024 253

INTERACTION EFFECTS ON THE DRAG OF BLUFF BODIES IN TANDEM [AERODYNAMICS, TRACTOR-TRAILERS]

An asymmetric configuration was studied in order to obtain a better understanding of the airflow over two tandemly-positioned bluff bodies in close enough proximity to interact strongly with each other, an interaction often beneficial in that the aerodynamic drag of the overall system is reduced. The configuration consists of a disc of diameter d1 coaxially placed in front of a flat-faced cylinder of diameter d2. For a given ratio d1/d2 (diameter of front body and rear body, respectively), there is a value of gap ratio, g*/d2, for which the drag of the forebody system is a minimum. In the most optimum configuration, d1/d2 equals 0.75,g*/d2 equals 0.375, and the corresponding forebody drag coefficient is 0.02, a remarkable reduction from the value of 0.75 for the cylinder alone. For each value of d1/d2, the minimum drag configuration, g*d2, appears to correspond to a minimum dissipation condition in which the separation stream surface just matches (joins tangentially onto) the rearbody. Support for this idea is furnished by comparison with some results derived from free-streamline theory and from flow visualization experiments. However, when g*/d2 exceeds a critical value of about 0.5, the value of CDmin (the minimum drag coefficient for fixed A1/A2 (frontal area of front-body and rear body, respectively)) is almost an order of magnitude higher than for subcritical optimum gap ratios. The increase seems to be connected with the onset of cavity oscillations. For non-axisymmetric geometry (square cross-sections) the separation surface cannot exactly match the rearbody and the subcritical minimum values of drag are higher than for circular cross-sections. The results show that there appear to be three flow regimes for the system with the square-edged rearbody that was investigated: if the shielding frontbody is absent or not optimized, the drag coefficient for the system has the ordinary, bluff-body value of order unity; for a well-designed system and for optimum values of gap ratio less than critical, the drag coefficient can be reduced almost two orders of magnitude below bluff-body values; for optimum gap ratios larger than critical, the drag coefficients are of intermediate magnitude. These changes may be characterized by the scale of the nonsteady motions that occur. In the low drag range, the scales of the eddies in the free turbulent shear layer spanning the gap are small and the eddy motion is independent of the gap geometry; in the intermediate regime fluctuations of larger scale occur, possibly because of a cavity oscillation; in the high drag, bluff-body regime, the oscillations are of a scale comparable to the body diameter.

by A. Roshko; K. Koenig
California Inst. of Tech., Pasadena, Calif.
Publ: HS-024 245, "Aerodynamic Drag Mechanisms of Bluff Bodies and Road Vehicles," New York, 1978 p253-86
1978; 11refs
Presented at symposium held in Warren, Mich., 27-28 Sep 1976. Research sponsored by Ford-Exxon Energy Res. Prog. of Calif. Inst. of Tech. and by National Science Foundation. Includes discussion.
Availability: In HS-024 245

HS-024 254

NUMERICAL MODELING OF BLUNT-BODY FLOWS--PROBLEMS AND PROSPECTS [AERODYNAMICS]

An efficient modeling technique ideally should incorporate the interactions among the turbulent boundary layer near the body, the unsteady, highly vortical wake flow behind the body, and the potential-flow regions outside these. The incomplete understanding of vortical, unsteady flow fields, in particular, turbulent boundary layers and their separation behavior, will preclude accurate modeling for the foreseeable future; but even coarse modeling methods could serve an important role in establishing cause-and-effect relationships. In particular, methods should be found which can be used to predict, at least qualitatively, the effect of small local body changes on local flow patterns and on the overall aerodynamic drag. A case is made for flow-field calculation methods based on the vorticity equations. Such methods have proved successful in aeronautical and meteorological applications. The overall drag and lift can be calculated in terms of the vorticity shed into the wake; in particular, the vortex drag associated with longitudinal vortices due to aerodynamic lift can be analyzed. Aerodynamic theory and numerical flow modeling can never realistically replace wind tunnel testing, but should primarily be used as a complement to it so that basic cause-and-effect relationships may be studied in more or less idealized flow conditions. There is an infinite variety of curious phenomena appearing in the flows of real fluids, and sometimes extreme sensitivity to minute changes in body shape or flow conditions, in particular when flow separation is involved. It will be a long time, if ever, before flows around complicated bodies such as automobiles can be computed directly from a numerical solution of the equations of motion.

by M. T. Landahl
Massachusetts Inst. of Tech., Cambridge, Mass.
Publ: HS-024 245, "Aerodynamic Drag Mechanisms of Bluff Bodies and Road Vehicles," New York, 1978 p289-311
1978; 19refs
Presented at symposium held in Warren, Mich., 27-28 Sep 1976. Includes prepared discussion by A. Leonard (NASA-Ames Res. Center) and informal comment.
Availability: In HS-024 245

HS-024 255

PROSPECTS FOR NUMERICAL SIMULATION OF BLUFF-BODY AERODYNAMICS

An improved understanding of the aerodynamics of bluff bodies such as road vehicles can lead to significant reductions in gasoline consumption and to increased safety and comfort, but to achieve these goals improved theoretical and experi-

mental techniques are urgently needed. The potential of using numerical-simulation methods for predicting and interpreting aerodynamic phenomena affecting bluff bodies is explored. As a basis for discussion, a prototype finite-difference method is described, and illustrated with sample calculations of air flow about simple bluff bodies. The limitations are then discussed in detail, together with some suggestions for extensions that could be realized in the immediate future. Speculations on what could be achieved in the next five to ten years to produce a generally useful research tool for bluff-body aerodynamics are presented in sections devoted to hardware and software developments. Among the possibilities are use of mini-computers for large-scale fluid dynamics calculations (although smaller and slower, these computers are cost effective); extending computational techniques to the use of sub-meshes to give increased local resolution, and techniques to provide better boundary conditions for outflow boundaries (providing major short-term savings in calculation costs); combining matched-expansion techniques and integral methods useful in analysis with numerical methods so that either inner or outer flow regions with relatively simple analytical solutions could be used as boundary conditions for detailed numerical calculation in the remaining portions of the flow field; attacking studies of isolated flow regions around wheel wells, window vents, windshield, etc. using course-mesh calculations of full vehicle configurations to produce boundary conditions for the more detailed flow calculations in isolated regions; using numerical schemes such as the Arbitrary-Langrangian-Eulerian method of the YAQUI code as a basis for new techniques with self-adaptive features; and self-testing and correcting programs that could detect instabilities or error accumulation, and make appropriate corrections without operator intervention.

by C. W. Hirt; J. D. Ramshaw
University of California Los Alamos Scientific Lab., Los Alamos, N. Mex.
ERDA-W-7405-ENG-36; NSF-AG-430
Publ: HS-024 245, "Aerodynamic Drag Mechanisms of Bluff Bodies and Road Vehicles," New York, 1978 p313-55
1978; 44refs
Presented at symposium held in Warren, Mich., 27-28 Sep 1976. Includes discussion.
Availability: In HS-024 245

HS-024 256

ON THE DEVELOPMENT OF A THEORY OF TRAVELER ATTITUDE-BEHAVIOR INTERRELATIONSHIPS. VOL. 1: INPUT TO THEORY DEVELOPMENT. FINAL REPORT

In this initial phase of a research project to develop a theory of traveler attitude-behavior interrelationships, effort was principally directed at the generation of materials to facilitate the development of such a theory. The central focus of this research is aimed at gaining a better understanding of the relationship between consumer attitude and traveler decision-making in order to allow planners to make better trade-offs among system design and operating features. This information on travel attitudes and behavior will be instrumental in developing analytical methods for the various specialists involved in transportation policy, planning, and operations. Literature review efforts were undertaken to survey attitudinal and marketing concepts which could contribute to theory development. Attitudes are divided into three components (cognition (beliefs), affect (feelings), and conation (behavioral intentions)) in order to better understand how they relate to traveler behavior. Hierarchical and multi-attribute models are explicitly considered. It is recognized that not all travelers are identical, and market segmentation is an aspect of the modeling orientation presented which is designed to account for differences among groups of travelers. A tentative model framework is presented along with an overview of how to quantitatively evaluate variations within the framework. Finally, a review of data collection considerations that support quantitative analyses of traveler attitude-behavior interrelationships is presented.

Charles River Associates Inc., 200 Clarendon St., Boston, Mass. 02116
DOT-TSC-1326-I
Rept. No. CRA-347-VoL-1; DOT-TSC-RSPA-78-14-1; 1978; 192p refs
Rept. for Jan 1977-Jun 1978. Vol. 2, Theoretical and Empirical Findings, is HS-024 257; Vol. 3, Executive Summary, is HS-024 258.
Availability: NTIS

HS-024 257

ON THE DEVELOPMENT OF A THEORY OF TRAVELER ATTITUDE-BEHAVIOR INTERRELATIONSHIPS. VOL. 2: THEORETICAL AND EMPIRICAL FINDINGS. FINAL REPORT

Conceptual and empirical findings which support the development of a theory of traveler attitude-behavior interrelationships are presented. Such a theory will be useful in the design of transport systems and operating policies which satisfy passenger requirements. A brief consideration of theoretical concepts precedes the review of empirical methodology. Structural equations, flow graphs, and two-stage least squares are briefly explained to provide a framework for understanding theoretical and empirical findings. General empirical results comprise a substantial portion of the discussion. The structure of traveler attitude-behavior interrelationships is examined for two transport modes, buses and car pools, over three different attitudinal transportation data sets (General Motors, Lovelock, and Federal Hwy. Administration travel surveys). Among the major findings are that traveler attitudes influence behavior toward transport alternatives and that traveler attitudes and behavior mutually affect each other. Various theoretical extensions of this work are described. A new quantitative procedure for assessing differences among travel market segments is developed and implemented. The relevance of the modeling orientation to transport system design and policy analysis, and some implications of the modeling approach for data collection efforts are noted. Policy implications which have emerged from the empirical analyses indicate that it is necessary to take account of the determinants of affect for transit operating policy and systems design in order to attain ridership goals, that favorable evaluation of attributes and attitudes towards these attributes is necessary but not sufficient to attain transit ridership, that transit capture of current auto riders is more difficult than the revealed trade-offs among attributes indicate, that it is necessary to stress traveler convenience over comfort in expenditures on transportation system improvements and information campaigns associated with systems, and that a market segmentation approach is necessary in transportation pol-

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icy analysis and simulation because of distinct differences among travelers in how attitudes relate to behavior.

Charles River Associates Inc., 200 Clarendon St., Boston, Mass. 02116
DOT-TSC-1326-2
Rept. No. CRA-347-VoL-2; DOT-TSC-RSPA-78-14-2; 1978; 245p refs
Rept. for Jan 1977-Jun 1978. Vol. 1, Input to Theory Development, is HS-024 256; Vol. 3, Executive Summary, is HS-024 258.
Availability: NTIS

HS-024 258

ON THE DEVELOPMENT OF A THEORY OF TRAVELER ATTITUDE-BEHAVIOR INTERRELATIONSHIPS. VOL. 3: EXECUTIVE SUMMARY; OVERVIEW OF METHODS, RESULTS, AND CONCLUSIONS. FINAL REPORT

An overview is presented of a research project which analyzed theories of traveler attitude-behavior interrelationships in an effort to understand the relationship between perceptions of system attributes and traveler satisfaction and behavior. The research derived techniques for quantifying attitudes and their interrelationships, and tested alternative theories. The theoretical development was oriented toward useful tools for transportation policy evaluation. The three principal components of the study included a literature review, the initial theory development, and an empirical validation. The literature review and acquisition component surveyed modeling concepts, principles of consumer and traveler behavior, and statistical methodology, which supported initial model specifications and identified quantitative methods suitable for their estimation. The literature review also determined which data sets were available for testing alternative model specifications. These empirical tests were conducted to develop a basic knowledge of traveler behavior which would facilitate transport analysis and policymaking. From the standpoint of specifying attitudinal models, results show that perceptions of system attributes (especially convenience) influence behavior; that affect (or behavioral intentions) is determined by attitudes toward the attributes of an alternative; that consumer choices are determined by affect towards an alternative, subject to objective constraints; that consumer attitudes (perceptions, affect, and intention) and behavior mutually influence each other; that perception and evaluation of each attribute is a function of the choices among alternatives made by the consumer as well as exogenous factors such as lifestyle, life cycle, and other demographic factors; and that different sets of structural assumptions about attitude-behavior interrelationships are relevant to alternative traveler segments, which can be defined with respect to behavior intention and possibly other variables.

Charles River Associates Inc., 200 Clarendon St., Boston, Mass. 02116
DOT-TSC-1326-3
Rept. No. CRA-347-Vol-3; DOT-TSC-RSPA-78-14-3; 1978; 39p refs
Rept. for Jan 1977-Jun 1978. Vol. 1, Input to Theory Development, is HS-024 256; Vol. 2, Theoretical and Empirical Findings, is HS-024 257.
Availability: NTIS

HS-024 259

THE OUTLOOK FOR AUTOMOTIVE CASTINGS

In the face of Federally-mandated standards requiring fleet averages of 27.5 mpg by 1985 for all auto makers, vehicle weights must be reduced. The potential applications of aluminum castings in the area of materials substitution are impressive. With the exception of high-temperature components such as exhaust manifolds, and highly stressed parts such as gears and spindle supports, virtually every pound of iron castings in the vehicle is potentially an aluminum casting. The automotive weight savings opportunities are substantial, 60% or more. Die-casting is generally the most cost-effective manufacturing process for aluminum castings because of production of lighter castings, through thinner casting sections; less machining, because of better dimensional repeatability and reduced machining allowance; and higher productivity, as a result of high solidification rates. A particularly good example of what can be achieved is the Ford 2.3-liter, 4-cylinder engine aluminum intake manifold, the first die-cast intake manifold in regular production when it was introduced in 1974. Of Ford's automatic transmission cases, 90% are aluminum die-castings; pump bodies and engine covers are other significant applications. These parts amount to over 70 lb per average Ford car in 1978. Even more aluminum must be used to meet weight reduction requirements, and a new casting high on the list of candidates is the cylinder block. The cylinder block, the heaviest casting in the powertrain, offers the largest single weight reduction in material substitution, from about 45 lb on a typical 1 to 4 cylinder block to 80 lb on a mid-size V-8 block. In assessing the economic impact of aluminum die-cast cylinder blocks, both the cost of potentially idling production iron sand-cast capacity and the cost of new die-cast plant facilities must be considered. Other current and potential aluminum die-cast components include housings for a rack-and-pinion steering gear, for a power-steering pump, and for ball-nut steering units, rear-wheel brake drums, wheels, and cylinder heads. By 1985, aluminum usage in cars and trucks will likely increase by about 125%, while the cast-iron content may diminish by as much as one-half.

by Paul T. Brosnahan
Publ: Foundry M and T p59-60, 64 (May 1978)
1978
Based on presentation at 1978 Annual Meeting of the Foundry Equipment Manufacturers Assoc.
Availability: See publication

HS-024 260

ENGINEERING DATA ON SELECTED HIGH SPEED PASSENGER TRUCKS. FINAL REPORT

Data have been assembled to characterize high-speed pas senger truck configurations for use in parametric studies to as sess the influence of truck (and vehicle) parameters on per formance characteristics such as vehicle stable performanc and ride vibration. The tabulated engineering parameter presented can be used for modeling of rail vehicle dynami performance which may lead to improvement of ride qualit and operational safety. A list is presented of high-speed pa senger trucks produced worldwide; indicated are the truck vehicle designation, the truck builder, whether it is powered unpowered, if data are available or not, the system on whi the truck is used, and the application (transit, mainline, commuter). This list has been condensed to include the follo ing selected high-speed trucks for which engineering data a

presented: France (Y-28, Y-32, Y-224, Y-225, Y-226), Italy (Fiat Eurofa, Z 1040), Germany (ET-403, Minden Deutz), Japan (DT 200), Canada (LRC), England (BT 10), U.S.S.R. (ER 200), and U.S. (P-III, Metroliner). These trucks were selected because the most complete data tabulations could be provided. All of the trucks or vehicles are designed for 125 mph (200 kph) or higher, except for the P-III (Amcoaches) which are locomotive-hauled and designed for 120 mph (193 kph). The basic design characteristics are summarized in a table; a description and a spring-mass-damper sketch of each truck are provided. For each truck, basic properties such as truck type, total truck weight per vehicle, car body RTR (ready to run) weight, and design speed, with the units specified in both the English and metric systems, are given along with tables on unsprung mass, sprung mass, and suspension characteristics in which are provided all the basic parameters essential for dynamic modeling activities. A discussion is presented on the influence of truck suspension parameter variations on railcar dynamic response.

by Stephen M. Shapiro
Budd Co., 300 Commerce Drive, Fort Washington, Pa. 19034
DOT-TSC-1222
Rept. No. FRA/ORD-78/29; DOT-TSC-FRA-78-4; 1978; 124p 95refs
Rept. for Apr-Nov 1977.
Availability: NTIS

HS-024 261

SAFETY VEHICLE ENVIRONMENTAL IMPACT AND THE FUTURE OF THE AUTOMOBILE INDUSTRY

A research project at the University of New Haven, the Bruce Tyndall Associates Project (BTAP), demonstrates the feasibility of aluminum technology in automobile design, and predicts significant cost-benefit relationships for consumers. Crash performance, durability, and fuel economy may be greatly enhanced. The BTAP prototype safety car investigation is a multidiscipline research program whose purpose is reduction of injuries from highway accidents, in particular accident survival. The research is organized around widely varying topics which are separately discussed: mathematics, dynamic impact analysis, prototype safety car design, BTAP safety frame, prototype production, capital investment, public and social research policy, and aesthetic considerations. The basic project is also placed in the context of a total environmental impact analysis. A planned extension of the project is discussed which would demonstrate the apparent major benefits, including longer vehicle life, improved crash protection without passive restraints, and substantial weight savings. Impact on the overall transportation system is assessed in terms of the parameters injury reduction, economic dislocation, and resource savings. Conclusions suggest that transportation system analysts should seriously consider major technological changes in automobile design to incorporate adaptions of aircraft industry technology.

by Bruce Tyndall
University of New Haven, West Haven, Conn.
1978; 31p 31refs
Reprinted from "International Logistics Symposium Proceedings. August 22-24, 1978, St. Louis, Mo." (Complete proceedings available from SOLE (Society of Logistics Engineers) International Headquarters, 3322 S. Memorial Pkwy., Suite 65, Huntsville, Ala. 35801 $10.00)
Availability: Corporate author

HS-024 262

AN EVALUATION OF THE SAFETY AND HANDLING PROPERTIES OF THE CAB-UNDER TRUCK-TRACTOR VEHICLE

A multidisciplinary investigation team undertook a study to evaluate the safety qualities of the Strick Corp.'s (Fort Washington, Pa.) cab-under heavy-duty truck-tractor-trailer system, and to estimate the changes that might occur in injury exposure to the driver and to the general driving public as a result of its introduction into the vehicle population. The following material concerning the cab-under concept (tractor placed completely under cargo body) was examined individually by each team member: detailed line drawings of the vehicle and some of its components, articles in technical journals concerning the vehicle, a motion picture of the vehicle in operation, letters and memoranda from several organizations (e.g. Teamsters, Dept. of Transportation, and Strick Mfg. Co.), and selected reports and studies from the Hwy. Safety Res. Inst. library. Discussions were then held on initial perceptions of the safety attributes of the cab-under vehicle; one of the vehicles was examined on two separate occasions, and interviews were conducted with the manufacturer's representatives, including the vehicle driver, the design engineers, and the program manager. It was concluded that the cab-under vehicle examined has major safety deficiencies in cab intrusion, down-the-road visibility, and vehicle roll and yaw sensing by the driver. Positive features are rollover reduction potential, safer ingress and egress, and lower center of gravity. Because of time and funding limitations, the evaluation by the study team was judgmental and qualitative, rather than experimental and definitive.

by Howard M. Bunch; John W. Melvin; Paul L. Olson; Richard G. Snyder; Christopher B. Winkler
University of Michigan, Hwy. Safety Res. Inst., Ann Arbor, Mich. 48109
Rept. No. UM-HSRI-78-13; 1978; 22p
Sponsored by International Brotherhood of Teamsters, Chauffers, Warehousemen, and Helpers of America (Teamsters), Safety and Health Dept.
Availability: Corporate author; International Brotherhood of Teamsters, 25 Louisiana Ave., N.W., Washington, D.C. 20001

HS-024 263

AN INVENTORY OF SELECTED MATHEMATICAL MODELS RELATING TO THE MOTOR VEHICLE TRANSPORTATION SYSTEM. FINAL REPORT

An inventory of 78 selected mathematical models (econometric, physical, accounting, etc.) relating to the motor vehicle system is presented. These models describe some impact on society and/or the environment and may have the potential for use in policy-related analyses. Each model is described in a format giving its objectives, limitations and benefits, structure, data and computer requirements, documentation, and other relevant information. Indexes are included which may be used to identify models according to name, author, sponsor, and type. Subject areas covered by the models include accidents, automobile demand and design, fuel consumption and economy, emissions, air and noise pollution, market share, modal split, fleet size, pricing, scrappage, trucks, weight, motorcycles, vehicle miles traveled, vehicle

operating performance, vehicle user costs, and vehicle manufacturing resource utilization.

by Barbara C. Richardson; Kent B. Joscelyn; D. Henry Golomb; Michael M. Luckey; Lawrence D. Segel
University of Michigan, Hw. Safety Res. Inst., Ann Arbor, Mich. 48109
Rept. No. UM-HSRI-78-28; 1978; 289p refs
Rept. for Jun 1977-Jun 1978. Sponsored by Motor Vehicle Manufacturers Assoc.
Availability: Corporate author

HS-024 264

THE IGNITION AND BURNING CHARACTERISTICS OF FABRIC COVERED FOAMS

A description is presented of a series of experiments carried out to study the ignition and burning characteristics of a range of upholstery foams covered with various fabrics (and interlinings). (Interlinings refer to fabrics placed between foam cushion and outer cover to attempt to improve fire performance.) For the ignition tests, seven standard flaming ignition sources are described which form a series of increasing energy from a level somewhat in excess of a match to that equivalent to about four sheets of newsprint. These ignition sources have been used to determine the largest ignition source which can be resisted by each fabric-foam combination (as a cushion) without producing a self-propagating flame or smoldering. The results are given of the performance of these fabric-foam combinations when combined as cushion slabs to form a mock-up chair and subjected to an ignition source (sufficiently large to cause ignition) in the room of a full-scale room-corridor test facility. Measurements are given of the general burning characteristics including the room temperatures, the volume of smoke, and the production of certain toxic gases. The work has shown that many of the combinations tested are easily ignited even when interlining and improved foams are used. Improved foams can give a substantial improvement in the rate of fire development but for maximum benefit, need to be combined with selected covers. The potential of interlining systems is clearly demonstrated, particularly in the reduction of fire spread and development. Some general advice is given about the utilization of the smoke measurements for calculating the approximate visibility which will be attained in compartments of known volume. The results should be of value to designers, purchasing and control officers, and others in the selection of material combinations to achieve performance criteria.

by W. D. Wooley; S. A. Ames; A. I. Pitt; K. Buckland
Building Res. Establishment, Fire Res. Station, Borehamwood, Herts., WD6 2BL, England
Rept. No. BRE-CP30/78; 1978; 24p 9refs
Availability: Building Res. Establishment, Distribution Unit, Garston, Watford, WD2 7JR, England

HS-024 265

CHAINED LIGHTNING. HIGH-OUTPUT IGNITIONS TO LIGHT YOUR FIRE [AUTOMOTIVE IGNITION SYSTEMS]

The evolution of automotive systems from the conventional point-type system to the various types of electronic ignitions in use today is discussed; various ignition systems available on the market are described. In less than a decade, ignition systems have undergone major changes. The standard point-type system, such as the Kettering system, uses the opening and closing of the breaker points to trigger the spark. These ignitions operate as well as any when in good shape, but they are subject to rubbing block wear, worn distributor shaft bushings, and point bounce. Dual-point distributors increase dwell time, allowing more coil saturation before the spark is triggered, but a dual-point ignition is still subject to rubbing block wear and high-speed point bounce. Electronic ignition systems have been developed to circumvent the various drawbacks of the breaker-point system. One of the earliest attempts at electronic ignition was the transistorized ignition system, but all of the inherent problems of a point-type system remained. Simpler and more efficient transistor systems are more plentiful today, but these systems are prone to failure and operate erratically when moisture is present. Capacitive discharge (CD) systems are a variation of the breaker-point system; the high-energy spark and the extremely fast rise time make these units very good at firing fouled spark plugs. They have a strong spark of short duration which works well with normal or rich mixtures. Magnetic-impulse systems were the next stage in the development of electronic ignition systems, and they were the first truly breakerless system. The problem with this system is that it is rate sensitive; at low cranking speeds, the spark can be quite weak, but it will be very strong at high rpm. This system is less desirable for cold starting, but high-performance applications may benefit from it. Additional benefits include an absence of point bounce, immunity to contaminants, no wear affect, and little maintenance. Variations of the magnetic-impulse system include the metal-detect systems which use metal-sensitive triggering units. Advanced electronics has resulted in the LED (light-emitting-diode) system which relies on a light-sensitive transistor. Because these systems rely on a light beam to trigger the spark, they can be sensitive to contaminants; but this is not a significant problem. The Hall effect system combines the LED and magnetic-impulse systems, using a magnet and a chopper wheel to trigger the spark. Like the optical system, it is relatively insensitive to wear and does not require close tolerances. Other specialized systems include magnetos, crank-trigger systems, and multiple-spark discharge units.

by John Baechtel
Publ: Car Craft v26 n10 p51-2, 55-6, 107 (Oct 1978)
1978
Availability: See publication

HS-024 266

STIRLING TECHNOLOGY PROVIDES QUIET NON-POLLUTING, EFFICIENT ENERGY FOR RV [RECREATIONAL VEHICLES] USE

The development and the characteristics of a total energy system for recreational vehicles (RV's) which utilizes a small Stirling engine as the power source are described. The system provides electricity, heat, and air conditioning at a higher comfort level. Simplicity of operation is an added benefit. In 1972, FFV (Sweden) and Thetford Corp. (U.S.) began working to develop such a system, FFV being responsible for developing the Stirling engine. The companies formed the Stirling Power Systems Corp. to develop a system utilizing the engine. Complete system integration in an RV has now been accomplished in cooperation with Winnebago Industries. The new Stirling engine is called a V160; it has two cylinders in a V configuration with a swept volume of 160 cc. In this particular application, the engine will operate at 1800 rpm and supply mechanical power to run a generator providing 6.5 kW of elec-

tric power. The Stirling engine design is based upon three key component areas: heating system, which supplies the heat necessary for operating the cycle; working gas seal, which prevents the gas from leaking from the cycle into the crankcase and also prevents lubricating oil from entering the closed cycle; and control system, which controls the air/fuel system as well as the power control system. A system utilizing this new engine as the core includes the following unique components: Stirling Power Pack (Stirling engine/generator), roof unit (includes two-ton air conditioning), electrical control center, control panel, heating system, junction box, battery charger/inverter, and wiring harness with quick disconnect connections.

by Lennart Johansson
Stirling Power Systems, Ann Arbor, Mich.
Rept. No. SAE-780693; 1978; 13p 1ref
Technical Paper Series. Presented at West Coast Meeting, San Diego, 7-10 Aug 1978. See also HS-024 267.
Availability: SAE

HS-024 267

WINNEBAGO COMBINES STIRLING TECHNOLOGY WITH UNIQUE MOTOR HOME DESIGN

A description is provided of the initial use of a newly designed Stirling engine as a total energy system for electrical, heating, and cooling requirements of a motor home. In this application, the low noise, low vibration, and inherent reliability of the Stirling engine have made possible substantial improvements in the design, convenience, utility, and operation of these systems in the motor home. Among the key features of this new design are simplified operation of the total energy system for the user; use of all-electric appliances, eliminating requirements for LPG (liquefied petroleum gas); and use of more efficient and effective air-conditioning and heating systems. For the motor home user, these features provide greater comfort and convenience, self-contained operation of the vehicle for longer periods of time, and use of the motor home in cold weather. This changeover to the Stirling engine has been accomplished in Winnebago's Elandan model. In the adaptation, the Stirling engine is mounted as a totally-enclosed unit (Stirling Power Pack) in a compartment of the motor home located about midway on the coach.

by J. Harold Bragg
Winnebago Industries, Inc.
Rept. No. SAE-780694; 1978; 11p
Technical Paper Series. Presented at West Coast Meeting, San Diego, 7-10 Aug 1978. See also HS-024 266.
Availability: SAE

HS-024 269

PARATRANSIT INTEGRATION SYMPOSIUM PROCEEDINGS. OCTOBER 14, 1977 [SUMMARY OF PRESENTATIONS]

Summaries are presented of 14 papers given at the Paratransit Integration Symposium held at the Transportation Systems Center, Cambridge, Mass. (the sponsor), the purpose of the symposium being to inform professionals in the paratransit field (i.e. planners, public- and private-transit operators, elected officials, and consultants) of the components of the Urban Mass Transportation Administration's (UMTA) Paratransit Integration Res. and Devel. Prog. UMTA officials and various experts in demand-responsive transportation who were conducting projects for UMTA presented papers focusing on the following five areas: Paratransit Integration Res. and Devel. Prog. overview, integration of services, paratransit alternatives, taxis as a public transportation provider, and development of support tools and dissemination of information.

by D. Krechmer; J. Strawbridge; P. Wenger; S. Zavatsky
Systems Architects, Inc., Transportation Systems Div., Thomas Patton Drive, Randolph, Mass. 02368
DOT-TSC-1369
Rept. No. UMTA-MA-06-0054-78-2; DOT-TSC-UMTA-78-21; 1978; 49p
Availability: NTIS

HS-024 270

ELECTRIC INFRA-RED HEATING

The scope and benefits of electric infrared (IR) heating, a versatile and inexpensive form of heating used in industry, are discussed. The basic principles of indirect heat transfer, including IR radiation, are briefly considered and the various types of IR emitters are described. These include short-wave heat lamps, short-wave quartz tubes, spot radiators, medium-wave quartz tubes, medium-wave flat quartz heaters, metal-sheathed elements, and ceramic radiators. It is pointed out that IR heat is as safe (or harmful) to personnel as any other industrial heat source. The scope for IR heating in four main categories is discussed: in mass heating (e.g. firing of vitreous enamels, plastics molding/vacuum forming, glass-to-metal sealing, molding of car windshields, billet heating, soldering and brazing, stress relieving of welds, glass annealing, metal heat treatment, shrink fitting of mechanical components, activating thermographic printing materials, blister packaging, heat setting of nylon fabrics, and softening bitumastic sound-deadening pads for car panels); in moisture removal (e.g. foundry molds and cores, molds for ceramics, plastic pellets before injection molding, pottery to "biscuit" state, water-based inks, coatings, and adhesives, paper webs and impregnated coatings, wood and chipboard, grain processing, photographic film, tobacco, dyed fabrics, food precooking and crisping, and removal of condensation from cans and bottles); in paint stoving (car finishes and underseals, paint finishes on manufactured products, electrostatic spray paints and powders, resin coatings on paper, metal, wood, etc., melamines, polyesters, alkyds, acrylics, lacquers, etc., print lamination, mirror backing, and wire insulation); and ink drying (e.g. sheet-fed offset litho- and screen-printing fields). A case study is presented of an IR oven designed for stoving the paint and primer on car-window hinge units. Additionally discussed are selection of equipment (matching, sizing, process/site conditions), sample testing, control methods, temperature measurement, maintenance requirements, typical equipment, standards and codes of practice, benefits, comparison with convection ovens, and capital costs. The main growth areas are likely to be in the wood, metal and plastics finishing fields. A promising newcomer is the litho printing field where ink drying times are reduced dramatically with IR heating.

by W. C. Hankins
Publ: Engineering v218 n9 pI-VIII (Sep 1978) 1978
Technical File No. 57.
Availability: See publication

HS-024 271

BOX-SECTION ROAD-HAULAGE TRAILER

The development of the Monoframe concept by Chris Hudson (International) Ltd. with the assistance of Rubery Owen-Rockwell, Dunlop Rubber Co. Ltd., and Panema Engineering Ltd. is described. It consists of a box-beam trailer chassis with independent suspensions. Given the requirement of independent suspensions at each wheel station, the initial design problem was to provide a structure combining the best possible means of supporting the trailer deck and also providing means of attachment for the independent wishbone suspensions. The best combination of configurations was to make the principal load-carrying member of the box-beam form, supporting the trailer deck by means of outriggers. This same box girder provides the most convenient means of pivoting the independent suspensions; vibration and shock loads from the wheels are taken by pneumatic springs mounted between the suspensions and the trailer deck frame. Modification of Rubery Owen-Rockwell axles enables the design to yield the maximum possible track width, thus contributing to the increased stability compared with conventional trailers. Adding to this stability is the fact that the monoframe chassis has its deck some 165 mm nearer the road than other designs. This low deck has been achieved by an extremely shallow neck, where the front of the semitrailer is attached to the tractor. The depth of the neck is 89 mm, compared with as much as 250 mm in other trailer designs. This neck depth is also the source of increased cargo capacity (2616-mm internal height). Other design features include high strength-to-weight ratio, interchangeable wheel stations, fitted double-diaphragm automatic spring parking brakes, constant chassis-floor height whatever the load, short landing legs for improved damage resistance and working life, and minimal maintenance requirements. Variations in length and general specifications for many alternatives are available, including heavy-duty versions for arduous environments and versions for chassis-less vehicles.

Publ: Engineering v218 n9 p874-5 (Sep 1978)
1978
Availability: See publication

HS-024 272

LIQUEFIED ENERGY GASES SAFETY. REPORT TO THE CONGRESS BY THE COMPTROLLER GENERAL OF THE UNITED STATES. VOL. 1

A comprehensive analysis is presented of the critical safety issues involved in the transportation and storage of liquefied energy gases (LEG), which include liquefied natural gas (LNG) and the liquefied petroleum gases (LPG) propane and butane. After an executive summary, chapters cover topics such as vulnerability of storage tanks and containment dikes to natural forces; crack-induced failure of metal LNG tanks; flow over containment dikes; ship design, personnel, and operations; truck and train shipments; vulnerability of LEG facilities to sabotage; the Cleveland LNG accident of 1944; liability and compensation; safety research and dispersion models; detonation and flame propagation research; the capability of non-urban sites to meet total U.S. import requirements for LPG and LNG; Federal, state, and local regulations; Federal regulation of LEG trucks and railcars; the Federal Power Commission; LNG use in Japan; overall conclusions and recommendations; and General Accounting Office (GAO) treatment of agency and company comments. It is concluded that the level of natural forces LEG facilities are required to withstand will be exceeded at many facilities in the next 50 years, that little attention has been paid to sabotage at LEG facilities, that a LEG tank failure in a densely-populated area would cause a catastrophe, and that in the event of massive rupture or collapse of a tank wall, over 50% of the LEG could escape over the dikes at five of the six facilities examined. To minimize the public risk involved in meeting the U.S. needs for these fuels, the following actions are recommended: build future facilities for storing large quantities of these gases in remote areas; no expansion in size or in use of facilities already in other than remote areas, and evaluation of the safety of each of these facilities by the Federal government; no transportation, unless delivery otherwise impossible, of large quantities of LEG through densely populated areas; consideration by Congress of the consolidation into one agency of many Federal responsibilities for evaluating and controlling the adverse consequences on energy operations; and creation by Congress of a Federal Hazardous Materials Compensation Fund to supplement private liability insurance.

General Accounting Office, Washington, D.C. 20548
Rept. No. GAO-EMD-78-28-Vol-1; 1978; 622p refs
Vol. 2, Appendixes, is HS-024 273; Vol. 3. Federal Agency Comments, is HS-024 274.
Availability: General Accounting Office, Distribution Section, Room 1518, 441 G St., N.W., Washington, D.C. 20548

HS-024 273

LIQUEFIED ENERGY GASES SAFETY: APPENDIXES. REPORT TO THE CONGRESS BY THE COMPTROLLER GENERAL OF THE UNITED STATES. VOL. 2

Appendixes are provided that support and supplement the General Accounting Office's comprehensive analysis of the critical safety issues involved in the transportation and storage of liquefied energy gases (LEG), which include liquefied natural gas (LNG) and the liquefied petroleum gases (LPG) propane and butane. Appendix I contains listings of contractors and consultants who contributed to this study, and of the facilities and organizations visited during the study. The remaining appendixes are numbered to correspond with their respective chapters in the main text. The subject headings of these appendixes are U.S. LEG and naphtha consumption, 1976; LEG storage site evaluation questionnaire; evaluation of 300,000 barrel Petrolane, Inc. liquid propane storage tank facilities, San Pedro, Calif., to withstand earthquake loading without rupture; design evaluation of tanks; crack-induced failure of metal LNG tanks; overflow; computational method; spigot flow; reactive safety equipment on LNG tankers; LEG containment systems; LNG incident experience to date; operating problems and ship delays; summary of port characteristics; some LNG truck accidents; analysis of causes of some underground explosions; recent bombing incidents; tank design and operating experience, East Ohio Gas Co.; Federal funding of safety research; LPG demand; LPG marine import terminals; identification of facilities; description of 12 LEG facilities; Federal regulations; state regulatory summary; special issues analyses; some pertinent statutory citations; applications to the Federal Power Commission for LNG terminal

facilities; list of safety evidence presented to the Federal Power Commission; and Japanese energy use.

General Accounting Office, Washington, D.C. 20548
Rept. No. GAO-EMD-78-28-Vol-2; 1978; 470p refs
Vol. 1 (Executive Summary and main text) is HS-024 272; Vol. 3, Federal Agency Comments, is HS-024 274.
Availability: General Accounting Office, Distribution Section, Room 1518, 441 G St., N.W., Washington, D.C. 20548

HS-024 274

LIQUEFIED ENERGY GASES SAFETY: FEDERAL AGENCY COMMENTS. REPORT TO THE CONGRESS BY THE COMPTROLLER GENERAL OF THE UNITED STATES. VOL. 3

Presented are comments made by various Federal agencies on the draft version of the General Accounting Office's (GAO) final report on the critical safety issues involved in the transportation and storage of liquefied energy gases (LEG), which include liquefied natural gas (LNG) and the liquefied petroleum gases (LPG) propane and butane. Represented are the Dept. of Commerce, Dept. of Energy, Dept. of State, Dept. of Transportation (Coast Guard, Materials Transportation Bureau, Federal Aviation Administration, Federal Hwy. Administration, Federal Railroad Administration), Interstate Commerce Commission, and National Transportation Safety Board. Comments from 34 private companies may be reviewed at the GAO.

General Accounting Office, Washington, D.C. 20548
Rept. No. GAO-EMD-78-28-Vol-3; 1978; 177p refs
Vol. 1 (Executive Summary and main text) is HS-024 272; Vol. 2, Appendixes, is HS-024 273.
Availability: General Accounting Office, Distribution Section, Room 1518, 441 G St., N.W., Washington, D.C. 20548

HS-024 275

MOBILOPATHY. THE OBSCURE PLAGUE OF THE TWENTIETH CENTURY--A NATIONAL DISASTER [HEALTH HAZARDS OF THE AUTOMOBILE]

The hazards of transportation, particularly those related to the automobile, are classified into a syndrome-disease, mobilopathy, which is defined as a disease of suffering due to motion by assisted transit modalities. The extent of this disease, of epidemic proportions, in the U.S. is reflected in motor vehicle accident statistics for 1976. The etiology (the motor vehicle), the vector (roadways), pathology (traumatic, medical, and psychological problems), symptomatology (directly related to the areas of trauma, cardiorespiratory distress, and bizarre behavioral patterns), therapy (directed to all the recent advanced modalities for trauma and cardiorespiratory and psychological disorders), prevention (automobile and road safety measures, mandatory seat belts, traffic safety education, alternate systems of public transit), and medical responsibilities for the future (involvement at every level of research and prevention) are discussed. The automobile, as the major form of transportation in the U.S., causes more deaths and disabilities in children than any other disease. Between the ages of 15 and 24 years, the car destroys more young people than all diseases and accidents combined. It is the fourth leading cause of death in all age groups. Despite epidemiological factors uncovered by statistical measurements in medicine which expose mobilopathy as an epidemic or plague, few preventive measures have been developed for alternate systems of transit. The medical profession, recognizing mobilopathy as a disease, must act to use the medical measurements of transportation hazards for preventive action.

by A. M. Grossman
Publ: Journal of Traffic Medicine v6 n1 p2-6 (Mar 1978)
1978; 34refs
Availability: See publication

HS-024 276

IDENTIFICATION OF THE DYNAMIC CHARACTERISTICS OF A BENCH-TYPE AUTOMOTIVE SEAT FOR THE EVALUATION OF RIDE QUALITY

The effect of seat transmissibility upon the spectra of motion of a typical bench-type automotive front seat (1975 Ford Maverick) was investigated. Vertical and lateral acceleration spectra were measured at the floorboard and at the passenger (70-Kg)/seat interface while the automobile was driven over highway test sections of various roughness levels. System transfer functions were identified from the experimental data using spectral analysis techniques. Analytical expressions, which can be used for system ride quality simulation and investigation, were determined which best fit the experimentally-determined transfer functions in a least-squares sense. The seat transfer functions were found to exhibit predominant resonances at approximately 4.9 Hz and 24 Hz. Since the 4.9 Hz resonance falls within the frequency region to which passengers are most sensitive, it possibly may have a significant effect upon the overall ride quality of the vehicle. In addition to the effect of these dominant resonances, the general effect of the seat dynamics is to effectively filter the higher frequency (above about 10 Hz) vertical motions while passing, or even amplifying, the higher-frequency lateral motions.

by C. C. Smith; Y. K. Kwak
Publ: Transactions of the ASME: Journal of Dynamic Systems, Measurement, and Control v100 n1 p42-9 (Mar 1978)
1978; 14refs
Availability: See publication

HS-024 277

THE PREDICTION OF PASSENGER RIDING COMFORT FROM ACCELERATION DATA [AUTOMOBILES]

Various methods for evaluating ride quality in automobiles were investigated by means of a field study involving two different automobiles (1974 Buick Century Luxus, 1975 Ford Maverick), 78 different passengers, and 18 different highway test sections (ranging in S.I. (serviceability index) from 1.9 to 4.3, and including a variety of roughnesses). Passenger rating panels were used to obtain subjective evaluation of the various rides, and measured vibration spectra were examined on the basis of various weighting techniques to determine their ability to predict the subjective ratings. Included in the evaluation criteria considered were weighting functions derived from the ISO (International Standards Organization), the UTACV (Urban Tracked Air Cushion Vehicle) Specification, acceleration limits as a function of frequency given by Janeway and Dieckmann, and the Absorbed Power method of Lee and Pradko. The various weighting techniques were compared by studying the correlation of the calculated ride indices, using a

particular weighting technique, with the Mean Personal (subjective) Rating of the passengers. Unweighted rms (root-mean-square) acceleration values were consistently as good as predictors of ride quality for both seat and floorboard vibration as the best weighted rms values, and are simpler and easier to use. The evaluation of the ride quality of an automobile can be accomplished using acceleration spectra measured either at the floorboard or passenger/seat interface in the vertical and transverse directions. Equations are presented to predict the subjective ride rating from measured vibration spectra.

by C. C. Smith; D. Y. McGehee; A. J. Healey
DOT-OS-30093
Publ: Transactions of the ASME: Journal of Dynamic Systems, Measurement, and Control v100 n1 p34-41 (Mar 1978)
1978; 12refs
Presented at Winter Annual Meeting of American Society of Mechanical Engineers, Atlanta, 27 Nov-2 Dec 1977.
Availability: See publication

HS-024 278

AUTOMOBILE FUEL ECONOMY ON FIXED URBAN DRIVING SCHEDULES

The differences in fuel economy measured using different fixed urban driving schedules can be satisfactorily explained in terms of a simple model relating fuel consumption to the average speed of urban traffic, previously derived by driving instrumented vehicles in actual street traffic. Fuel economy data were analyzed for each of 111 automatic-transmission 1976 model year vehicles; these data were collected for each of the following three driving schedules: SAE (Society of Automotive Engineers) urban (road schedule defined by a number of constant-acceleration, constant-speed, and constant-braking segments to be performed at specified distances along the test track); GM (General Motors) city-suburban (road schedule defined in terms of a number of acceleration, constant-speed, and acceleration segments), and EPA (Environmental Protection Agency) LA-4 (dynamometer schedule defined by a specific second-by-second speed-time history). Based on vehicle masses and idle fuel-flow rates, and on constants determined for one-third of the vehicles, the fuel economies for the remaining two-thirds were predicted on any of the fixed urban driving schedules with a root-mean-square (rms) error of 8.8%. Furthermore, given the fuel economy for a particular car on one of the driving schedules, the fuel economy for that car on the other schedules can be predicted with an rms error of 5.6%. The agreement of the fuel-economy measurements using fixed urban driving schedules with the model of urban fuel consumption derived from actual urban traffic supports the view that the schedules contain speed-time characteristics appropriate for their average speed, i.e. each schedule provides an effective representation of traffic-related factors that influence fuel consumption for driving in urban traffic with the same average speed as the average speed of the schedule. The overall consistency of the results suggests that the microscopic details of a speed-time history are relatively unimportant in determining fuel consumption. What matters is that the general characteristics be appropriate for the average speed. That the measurement on any of the fixed urban driving schedules provides sufficient information to estimate the fuel economy of the others, or at any average urban speed, argues strongly against the introduction of additional schedules.

by Leonard Evans; Robert Herman
Publ: Transportation Science v12 n2 p137-52 (May 1978)
1978; 14refs
Availability: See publication

HS-024 279

DRIVE-ON CAR RAMPS [PERFORMANCE RATINGS]

The strength and stability were tested of 19 different drive-on car ramps, used in personal routine automobile maintenance and repair. Five tests were conducted to judge the ramps' performance: ease of climbing, stability on concrete, resistance to flipping, resistance to tipping, and traction. Data are tabulated for the various brands/models as to price, weight rating/pair (manufacturer's claimed capacity), factor of safety (as determined by testing), lift height, track width, ease of climbing, stability on concrete (coarse, smooth), resistance to flipping, resistance to tipping, traction when wet, effectiveness of tire stop, advantages, disadvantage and comments. The performance factors of each model are rated as either excellent, very good, good, fair, or poor. The following models were judged acceptable: Noble Pyramid (top-rated), Mark Fore Maxi-Ramp 75A, Sears Cat. No. 1234, Kar Rite 1033, Sears Cat. No. 1232, Foxcraft CR-77, Acrobilt Super Ramp, Car Care 302220, Foxcraft CR-1, Sumco Taskmaster KD10R, Spartan AR-1, and J. C. Whitney 89-9370B. Five models were judged conditionally acceptable (because they could gouge a car's tires): Car Care 302210, Wards Cat. No. 85605, Car Care 302120, Car Care 302110, and Wards Cat. No. 85604. The Foxcraft CR-75 (did not safely hold twice its rated weight) and the Huffy 2101 (did not safely hold twice its rated weight and may fail suddenly if overloaded) were judged unacceptable. Tips for using car ramps properly are outlined and illustrated.

Publ: Consumer Reports v43 n10 p588-91 (Oct 1978)
1978
Availability: See publication

HS-024 280

SIMPLIFYING SUSPENSIONS [AUTOMOBILE SUSPENSION SYSTEMS]

An analysis is made of the different types of independent suspension systems for automobiles. The complexities of the systems (wheels being attached to the car body by wishbones, arms, struts or bars) are more apparent than real. It is possible for two different arrangements to have identical characteristics. An engineer may change design slightly for geometrical, structural, acoustic or space-saving considerations. The basic parameters of the system characteristics and their effects on car handling are explained and illustrated in terms of geometry and roll center effects, the roll center being the imaginary point in the plane of the wheel hubs. The position of the roll centers (front and rear) and the orientation of the roll axis (line joining the two centers) are fundamental to the analysis. Weight transfer in cornering and anti-dive control are discussed. The alteration of suspension geometry by the use of

rubber joints or bushes and the tendency of the front wheels to toe-out under violent braking are described.

by Rex Greenslade
Publ: Motor v154 n3964 p38-41 (30 Sep 1978)
1978
At head of title: Technicalities Untangled.
Availability: See publication

HS-024 281

CARELESS DRIVERS MAY FIND THEMSELVES CARLESS

During 1977, 1.5 million cars were stolen in the U.S. (one theft every 32 seconds). Prime targets are late model, personal luxury cars, those that are common enough so that they can be stolen, repainted, fitted with new identification tags taken from a similar, wrecked model, and resold. Many cars stolen by professionals are stolen to order, especially in California where they are then shipped to Mexico or South America. A stolen car can be dismantled in a chop shop and sold for parts, a lucrative business. Common sense, such as locking the car doors and not leaving the keys in the ignition, can help prevent auto theft. Since 65% of auto thefts are the work of amateurs, the door is the first line of defense. Door lock tabs should be replaced with ones without lips, thus discouraging the use of a wire to open the lock. Professional thieves are hard to combat. They use bogus tow trucks, "slim jims" or hacksaws to trip the door lock, and dent pullers to remove the ignition-steering column lock. Deterrence is the best weapon. Anti-auto-theft devices are recommended as long as they are not the factory-ordered items for which servicing information is too readily available for the thief. Whatever antitheft system is utilized, its presence should be advertised (decals on a car stating that it is protected will deter amateurs and may make a pro try a different car). The device that cuts the engine two or three minutes after a car is started is not recommended because of a possible resulting traffic hazard. Strongly advocated is the Identicar System in which all the vehicle glass is permanently engraved with an identification code. This code is recorded in a national registry and assists law enforcement agencies in recovery. Windows with codes also make stripping the car for parts unprofitable.

Publ: Automotive Fleet v17 n11 p56-8 (Sep 1978)
1978
Availability: See publication

HS-024 282

VEHICLE OPERATING EXPENSES CONTINUE TO CLIMB IN U.S.

The Hertz Corp.'s annual study on motor vehicle operating costs and fuel usage in the U.S. shows that for 1977 the nation's total spending to own and operate cars and trucks topped $376 billion, more than $51 billion (15.6%) above 1976. More than half the increase ($26.9 billion) is attributed to higher per-mile expenses for almost all elements of driving, including vehicle purchase prices, insurance premiums, interest charges, fuel costs, and maintenance. The other $24.3 billion of the increase is attributed to the record 143.8 million cars and trucks now on American roads, each averaging 9649 miles of travel per year. The total 1.387 trillion vehicle miles a year is also a new high. The study shows that aggregate motor vehicle outlays have more than doubled in the past five years. For 1977, there was an average outlay increase of $249 for every car and truck, bringing per-unit costs to $2615 (27.1 cents per mile). Insurance, licensing, and fees lead the 1977 increases, rising $18 billion, 30%, over 1976; depreciation climbed $12.5 billion or 14.3%; cost of maintenance, parts, repairs, etc., increased $8.5 billion or 11.1%; fuel outlays rose $7.6 billion or 11.6%; interest payments advanced $4.7 billion or 13.4%. In 1977, Americans spent $218.4 billion to drive their 114.1 million passenger cars a total of 1.049 trillion miles (161 billion miles for non-personal driving). The 1977 passenger car spending equals $1904 per car, or 20.7 cents per mile, which exceeds the $1812 (20.1 cents per mile) in 1976 for all cars. Per-auto expenditure in 1977 amounted to 27.1% of the average American's personal income, a decrease from 28.3% in 1976 and from nearly 48% in 1950. However, on a per-capita basis, Americans today spend about the same share of their income on cars as they did over a quarter century ago (14.3% and 13%, respectively). The 1977 spending for ownership and operation of trucks soared to $157.7 billion ($5310 per unit, 46.7 cents per mile) from the $126.1 billion ($4594 per unit, 42 cents per mile) total in 1976, a 25% increase. Close to $14.7 billion is attributed to increased vehicle purchase and running costs, while the remaining $16.9 billion resulted from the higher number of trucks covering more miles. In the period from 1950 to 1977, per-gallon fuel costs rose 141%, slightly below the overall 152% U.S. inflation rate during that time. However, per-vehicle purchase prices and per-mile ownership and operating cost increases (242% and 207%, respectively) were substantially above the cost-of-living climb over those years.

Publ: Automotive Fleet v17 n11 p46, 48-9 (Sep 1978)
1978
Availability: See publication

HS-024 283

DIESELS: POWER AND ECONOMY WITH NO SPARK

The diesel engine's principles and inherent advantages and disadvantages are explained. The diesel's basic operation is identical to that of a gas engine. Both are four-stroke engines and when the fuel/air mixture is ignited, it burns with increased temperature and pressure, driving the piston downward to turn the crankshaft and, in turn, deliver the power. The factor that distinguishes the basic nature of the diesel from that of the gas engine is the manner of ignition. As opposed to spark ignition by an electrical system, the diesel has no electrical system and ignition is through spontaneous combustion. Air is drawn into the cylinder on the intake stroke and compressed at a 22.5:1 ratio (vs. 8:1 ratio of gas engine). Under such extreme compression, the temperature of the air rises appreciably, and at the top of the stroke, where compression is the highest, fuel is injected into the cylinder and ignites as a result of the heat from compression as well as from the cylinder walls. Because of the compression and heat requirements, glow plugs are needed to fire up the engine. The plugs warm the fuel in a pre-combustion chamber and the preheated fuel ignites when injected into the cold cylinder. The diesel is noisiest and belches black smoke when first started, problems which subside once up to operating temperatures. Because the diesel's compression ratio (CR) is so high, the internal components, as well as the block itself, must be made of heavier and stronger metals than used in gas engines. Heavier parts result in more vibrations at higher engine speeds and, consequently, diesels in the past were relegated to low-speed

operations. Modern diesels have overcome some of these problems. Today's automobile diesel engines range from 3600 rpm to 5000 rpm vs. 5000 rpm to 7000 rpm for gas engines. Diesels, because of the high compression and air-to-fuel ratio, produce a lower level of emissions and currently do not need special emission equipment. The increased blow-by of particulate matter due to the high CR contaminates the crankcase oil; diesels have a more frequent oil-change interval as a result (3000 mi vs. 7500 for conventional engines). The diesel is more fuel efficient than gasoline engines (25% more efficient). The fuel economy is related to the high CR and to the fuel itself which generates about 10% more energy per gallon than gasoline. Since diesels cost more than other cars initially, it takes time for fuel savings to be realized. Durability may be an attractive feature.

Publ: Automotive Fleet v17 n11 p24-6 (Sep 1978)
1978
Availability: See publication

HS-024 284

ENVIRONMENTAL AND CONSERVATION CONCERNS IN TRANSPORTATION: ENERGY, NOISE, AND AIR QUALITY

This compilation of 12 papers on the subject of environmental and conservation concerns in U.S. transportation covers impact of mandatory fuel economy standards on future automobile sales and fuel use; energy-saving potential of transit; rail rapid transit and energy: the adverse effects; energy-crisis travel behavior and the transportation planning process; maximum potential energy savings resulting from a cessation of Federal aid to urban highway construction; policy preferences for conservation of transportation energy in case of fuel shortage; Leq (energy-equivalent sound level) traffic noise prediction method; comparative analysis of HIWAY, California, and CALINE2 line source dispersion models; Philadelphia air quality control region: need and recommendations for revision of transportation control plan; development of criteria for reserving exclusive bus lanes; line source emissions modeling; and use of traffic simulation in analysis of carbon monoxide pollution.

by Mary McLaughlin, ed.
National Acad. of Sciences, Transportation Res. Board, 2101 Constitution Ave., N.W., Washington, D.C. 20418
Rept. No. TRR-648; 1977; 82p refs
Includes HS-024 285--HS-024 293.
Availability: TRB $4.80

HS-024 285

IMPACT OF MANDATORY FUEL ECONOMY STANDARDS ON FUTURE AUTOMOBILE SALES AND FUEL USE

Projecting and evaluating the impact of mandatory fuel economy standards and gasoline taxes on automobile sales and fuel consumption in the U.S. is based on explicit estimates of the cost to improve the technical efficiency of new automobiles and a behavioral model of consumer choice of car by market class. Six alternative policies are evaluated in terms of their impact on fuel consumption, sales-weighted fuel economy, automobile sales, scrappage of vehicles, fleet composition, and vehicle kilometers of travel: baseline, gasoline tax, moderate Energy Policy and Conservation Act of 1975 (EPCA) standards, stringent EPCA standards, moderate EPCA with gasoline tax, moderate EPCA with double penalties. All b the first option involve government policies directed towa improving fuel economy and reducing fuel use. Increases gasoline prices are found to have considerable potential f reducing automotive fuel consumption but only at the expen of creating equally sizable reductions in vehicle kilometers travel and in the number of cars sold. Judged by the standa of minimal impact on car sales and travel, moderate fue economy standards with double civil penalties appear achieve the most desirable impact; fuel consumption reduced by 12.4% in 1990 and car sales and vehicle kilomete of travel down by only 5.4% and 1.3% respectively, relative baseline. In contrast, gasoline tax reduces 1990 fuel consum tion by slightly less (11%), but car sales and vehicle kilomete of travel are down by much more (15.5% and 9.8% respectiv ly). The moderate fuel economy standards achieve 1990 redu tions of 8.2% in fuel use, 5.4% in car sales, and 1.9% in vel cle kilometers of travel. Stringent standards result in redu tions in car sales and travel of 8.5% and 2.6% respectivel These impacts are not as favorable as those achieved by usi the double-penalty approach, but compare favorably wi gasoline taxes, offer considerable conservation benefits cor pared with baseline, and result in relatively minor econom and travel disbenefits. Early indications suggest that the sta dards incorporated in the existing legislation may be unattain ble and that revisions in both the standards and the penal structure might produce better results.

by Damian J. Kulash; Carmen Difiglio
Jack Faucett Associates, Inc.; Department of Energy
Publ: HS-024 284 (TRR-648), "Environmental and Conservation Concerns in Transportation: Energy, Noise, an Air Quality," Washington, D.C., 1977 p1-7
1977; 5refs
Availability: In HS-024 284

HS-024 286

ENERGY-SAVING POTENTIAL OF TRANSIT

An investigation was undertaken to quantify the nationwi transportation mode shifts and energy savings that would caused by implementation of alternative transit-oriented strat gies in the U.S. The study was primarily concerned with t potential impacts and energy efficiencies of short-term polici designed to induce automobile drivers to shift to public tran portation (e.g. bus, rail rapid transit, commuter rail, dial-ride). Policies to induce such mode shifts were grouped as fo scenarios for evaluation, including such actions as decreasi transit fare, decreasing transit running time, increasi gasoline cost, increasing selected parking costs, decreasi transit excess time, and decreasing wait time. Possible tran portation energy savings for urbanized areas as well as redu tion in vehicle kilometers of travel were first estimated for i dividual representative cities (Albuquerque, San Diego, B timore, and Chicago) and then expanded to provide a nation estimate for each of the four scenarios. The estimates sho that a reduction in the amount of energy used for person transportation can be realized through actions designed to shi persons from the automobile to mass transit, but that it is e tremely difficult to conserve large quantities of energy in th way. The potential short-term fuel savings attainable fro shifts to transit range from less than 1% up to a maximum 3% or possibly 4% of national, urban-area fuel consumpti for personal travel. The maximum reductions would invol twofold to threefold and greater transit ridership increases individual cities, with corresponding transit subsidy increase

Transit fare reductions, decreased running time, increased service coverage and frequency, and automobile disincentives all serve to increase transit ridership and, in most cases, to conserve energy. However, energy savings resulting from individually-applied policy actions are less than those resulting from appropriate joint applications of policy. Auto-disincentive strategies will not only generate energy savings via shifts to transit but also via increased car and van pooling, shortened trip lengths, and trip elimination. To conserve energy, increased coverage and frequency of transit service are best provided in connection with fare reductions, decreased running time, or auto disincentives. The potential for reducing vehicle kilometers of car travel in urban areas is twice as great as total energy-saving potential, ranging from 1% or 2% up to a maximum of 6% or possibly 8% for the highest impact group of mode-shift strategies examined.

by Phillip S. Shapiro; Richard H. Pratt
R. H. Pratt Associates, Inc., Kensington, Md.
Publ: HS-024 284 (TRR-648), "Environmental and Conservation Concerns in Transportation: Energy, Noise, and Air Quality," Washington, D.C., 1977 p7-14
1977; 5refs
Research sponsored by Federal Energy Administration.
Availability: In HS-024 284

HS-024 287

ENERGY-CRISIS TRAVEL BEHAVIOR AND THE TRANSPORTATION PLANNING PROCESS

An investigation was made of the adjustment strategies adopted by individual households in response to situations of real and potential fuel shortages and higher prices, and of the attitudes of individual households toward regional policies to deal with existing or prospective transportation facilities and costs. The study used a mail questionnaire distributed in Nov 1975 to a random sample of households in southeastern Wisconsin which asked respondents to list the types of transportation strategies they used during the fuel crisis period of 1973 to 1975, and what strategies they might use if there were a future fuel scarcity and if the price of gasoline were increased by $0.05/L ($0.20/gal). Over 75% of the sampled households (a total of 1461 usable returns) made multiple adjustments in travel behavior during the fuel crisis, most commonly involving some combination of distance-related and behavioral changes in travel. Households preferred an adjustment strategy of careful retreat, making changes that caused the least disruption to their precrisis travel patterns and putting off difficult decisions that would involve major changes. For example, about 70% made one or more of the following changes in shopping behavior: combined several shopping trips, combined shopping trips with other trips, made fewer shopping trips, and shopped at stores closer to home. Besides reducing the frequency of trips and changing the places visited, about 50% of the households made one or more of the following adjustments: purchased an additional car that was smaller than cars already owned, traded in a larger for a smaller car, sold one car and did not replace it, postponed purchase of a second car, purchased a motorcycle, and shifted mode for trip to work. Over 40% of the households made changes in recreation travel. Residential relocation as a response to the fuel crisis was rare. Nine percent of the households indicated no change in travel behavior. Households indicated that, if the price of gas were increased with no limit on its availability or if gas stayed at the current price but were restricted, they would more than likely adopt multiple strategies in the future. According to the respondents, an increase in gas prices would have a substantially less severe mode-shift impact on work trip than would gas rationing. Households would be very reluctant to move closer to jobs. The results suggest that the transportation planning process needs substantial revision under conditions of excessive fuel-price increases or restricted fuel availability. Moderate and gradual increases in fuel prices are unlikely to bring about significant modifications in the travel patterns of households.

by Thomas M. Corsi; Milton E. Harvey
University of Maryland, Coll. of Business and Management; Kent State Univ.
Publ: HS-024 284 (TRR-648), "Environmental and Conservation Concerns in Transportation: Energy, Noise, and Air Quality," Washington, D.C., 1977 p30-6
1977; 7refs
Prepared in cooperation with Urban Res. Center and Center for Urban Transportation Studies of the Univ. of Wisconsin-Madison, and Southeastern Wisconsin Regional Planning Commission.
Availability: In HS-024 284

HS-024 288

MAXIMUM POTENTIAL ENERGY SAVINGS RESULTING FROM A CESSATION OF FEDERAL AID TO URBAN HIGHWAY CONSTRUCTION

Evidence indicates that a cessation of Federal capital assistance to urban highway construction would not contribute significantly to the conservation of energy used for urban highway travel in the U.S. The effect of such a policy would be weakened by four factors: additional facilities built with Federal grants would not significantly affect highway capacity; Federal grants have not been as effective in stimulating urban highway construction as their matching requirements would suggest; off-peak travel, which constitutes most of the total urban vehicle kilometers of travel, would not be affected significantly; and increased congestion would reduce vehicle operating efficiency and thus increase energy consumption. A sensitivity analysis shows a maximum potential energy savings resulting from cessation of Federal aid to urban highway construction (using upper-bound assumptions on the reduction in highway peak-period travel resulting from reduction in highway capacity) of only 1.3% nationwide reduction in 1989 urban automobile energy consumption in response to an elimination of the entire urban Federal-aid highway program between 1974 and 1989. Direct actions to reduce the demand for vehicle travel in metropolitan areas and to improve fuel efficiency of cars will be much more effective than indirect programs such as attempts to restrict highway capacity. These direct measures would include congestion tolls or other highway-entry controls, in selected urban areas that are characterized by the most severe congestion, and improved automobile fuel efficiency, if higher fuel prices are ruled out as a policy alternative.

by William B. Tye; Milene Henley; Michael J. Kinnucan
Charles River Associates, Cambridge, Mass.
Publ: HS-024 284 (TRR-648), "Environmental and Conservation Concerns in Transportation: Energy, Noise, and Air Quality," Washington, D.C. 1977 p37-42
1977; 14refs
Availability: In HS-024 284

HS-024 289

POLICY PREFERENCES FOR CONSERVATION OF TRANSPORTATION ENERGY IN CASE OF FUEL SHORTAGE

The attitude and behavior of travelers during the oil embargo of the winter of 1973-1974 were analyzed. Immediately after the embargo period, questionnaires containing forced-choice pairs of combinations from a set of ten possible transportation-related energy-conservation policy actions were mailed to 2323 households in regions of Iowa that did not contain a city of 50,000 or more population. The policy actions included six alternatives in the form of constraints: gasoline price ($0.26/L and $0.80/L ($1/gal and $3/gal)), fuel supply (37.8 L/wk and 18.9 L/wk (10 gal/wk and 5 gal/wk)), and intercity travel-speed (rigid 88.5-kph (55-mph) speed limit and 72-kph (45-mph) speed limit at present enforcement level). Four policy actions in the form of incentives were utilized: tax to promote automobile efficiency (less than 8.5 km/L (less than 20 mi/gal)), and individual participation (subsidies to bus systems to encourage increased ridership, special incentives to car pooling, and voluntary reduction in household travel). Tabular analysis of data from the total of 1398 questionnaires analyzed indicated that respondents overwhelmingly favor policies of uniform speed regulation and voluntary participation and are strongly opposed to increased fuel prices as a conservation policy. Analysis of the data by means of paired-comparison scales indicated that the aggregate sample is more concerned about the degree of constraint and its effect on lifestyles than about the type of conservation policy (pricing vs. rationing). Young adults favor severe rationing or severe price increases less than other groups. Persons earning high incomes favor voluntary participation more than speed-limit regulation, and low-income and middle-income groups feel the opposite. Regions with few high-speed highways favor the 88.5-kph speed limit significantly more than do other areas. Public acceptance of any future transportation-related energy policy appears to be strongly related to the perceived distribution of available transportation options.

by Kenneth A. Brewer; Bernice H. Gray
Iowa State Univ., Engineering Res. Inst.
Publ: HS-024 284 (TRR-648), "Environmental and Conservation Concerns in Transportation: Energy, Noise, and Air Quality," Washington, D.C., 1977 p42-8
1977; 8refs
Based on research sponsored by Dept. of Transportation, Office of Univ. Res., and Iowa State Univ., Engineering Res. Inst.
Availability: In HS-024 284

HS-024 290

Leq [ENERGY-EQUIVALENT SOUND LEVEL] TRAFFIC NOISE PREDICTION METHOD

The original 1974 Ontario highway noise prediction method, which predicts L10 and L50 sound levels (sound levels exceeded 10% and 50% of the time) for all typical highway situations, has been expanded to include a simple, reliable prediction of Leq (energy-equivalent sound level). The development, accuracy, reliability, and application of the new methodology, which is based on 182 sound measurements taken near rural and urban freeways, highways, and residential streets, are described. The method is in the form of a nomograph and can be used to predict traffic noise on both highways and residential streets. The standard error of estimate for the Leq method is about 2.24 dB(A), suggesting that in about two of three cases the levels will be within plus or minus 2dB of the true measured values. Comparisons of measured calculated Leq levels indicate that this method is more ac rate than the Revised Design Guide method of the Natic Cooperative Hwy. Res. Prog. A simple method for direct p diction from annual average daily traffic volumes of day-n A-weighted equivalent sound levels (Ldn) caused by tra noise is included.

by J. J. Hajek
Ontario Ministry of Transportation and Communications, O Canada
Publ: HS-024 284 (TRR-648), "Environmental and Conservation Concerns in Transportation: Energy, Noise, a Air Quality," Washington, D.C., 1977 p48-53
1977; 19refs
Availability: In HS-024 284

HS-024 291

COMPARATIVE ANALYSIS OF HIWAY, CALIFORNIA, AND CALINE2 LINE SOURCE DISPERSION MODELS [CARBON MONOXIDE CONCENTRATIONS NEAR HIGHWAYS]

The Environmental Protection Agency's (EPA) HIWAY, California Line Source, and the CALINE2 diffusion moc for prediction of carbon monoxide (CO) concentrations n highways, all models based on the Gaussian dispersion eq tions, are compared by means of sensitivity analysis model validation. The sensitivity analysis examines the dep dence of normalized pollutant concentration on variations several independent input parameters such as Pasquill mospheric stability class, wind angle with respect to highway, and receptor distance from the highway. The th different models are validated by comparing CO concen tions measured near a highway with concentrations predic by the models. The sensitivity analysis results show variat in normalized pollutant concentration with downwind dista under crosswind conditions for all three models. The Calif nia Line source model and CALINE2 perform similarly, only difference being that CALINE2 predicts 20% less po tant concentration for all downwind distances. Genera HIWAY predicts higher pollutants than the other two moc for the crosswind case. Initial concentrations predicted by California models are not sensitive to stability classificati whereas HIWAY is. The rate of dispersion for the Califor models is greater than that of HIWAY within 20 m (66 ft) the highway; beyond 20 m, HIWAY has a greater rate dispersion. For pollutant variation with downwind distance parallel winds, HIWAY and CALINE2 perform similarly cept that HIWAY predicts an initial concentration about tw that predicted by CALINE2. The California Line Sou model generally predicts higher pollutants for the parallel w case. For pollutants vs. normal distance from the highway oblique-wind conditions, the EPA model generally predi higher concentrations than the California models, except stability class E and distance less than 30 m (98 ft) and stat ty class B and distance greater than 70 m (230 ft), wh higher predictions are made by CALINE2 and California L Source, respectively. For oblique wind, HIWAY CALINE2, but not California Line Source, predict initial p lutants as a function of stability class. The overall precisi as determined by validation analysis, of CALINE2 (correlat coefficient, r equals 0.53) is slightly greater than that HIWAY (r equals 0.49) and the California Line Source mo

(r equals 0.51). This precision is improved when the data are separated by wind angle, but it is generally less than that exhibited by the other models for the same categories.

by Kenneth E. Noll; Terry L. Miller; Michael Claggett
Illinois Inst. of Tech., Dept. of Environmental Engineering; Enviro-Measure, Inc., Knoxville, Tenn.
Publ: HS-024 284 (TRR-648), "Environmental and Conservation Concerns in Transportation: Energy, Noise, and Air Quality," Washington, D.C., 1977 p53-8
1977; 12refs
Availability: In HS-024 284

HS-024 292

PHILADELPHIA AIR QUALITY CONTROL REGION: NEED AND RECOMMENDATIONS FOR REVISION OF TRANSPORTATION CONTROL PLAN

The Philadelphia transportation control plan (TCP), its status and evaluation process, and the technical background on which it was based are evaluated. The Philadelphia TCP, published in Nov 1973, was the result of the Clean Air Act of 1970 which mandated transportation control measures for air quality control regions (AQCR's), areas in which controls on stationary sources (e.g. power plants) combined with Federal emission standards for new automobiles were considered inadequate to ensure attainment or maintenance of the ambient air quality standards. Strategies for reducing vehicle kilometers of travel in the Philadelphia AQCR are the core of the Philadelphia TCP. A summary of TCP strategies is presented as well as a review of their status and the major implementation problems of the plan. Legal, administrative, and technical problems are found to exist. A review and an analysis of the latest air quality data for the Philadelphia central business district are presented. Air quality standards are found to be based on limited studies and do not take into account time of day, frequency, or duration of high concentrations of pollutants. The power of the Environmental Protection Agency to regulate the states or to require them to enforce a regulation is questioned. A need for revising the Philadelphia plan is established, and it is recommended that the metropolitan planning organization be involved in the revision process. Candidate strategies for a revised TCP include improving automobile alternatives and vehicle movement on highways, reducing automobile use, requiring vehicle inspection and maintenance programs, and improving the energy efficiency of vehicles.

by C. Abdul Latif; Rasin K. Mufti
Delaware Valley Regional Planning Commission
Publ: HS-024 284 (TRR-648), "Environmental and Conservation Concerns in Transportation: Energy, Noise, and Air Quality," Washington, D.C., 1977 p59-65
1977; 9refs
Sponsored in part by Federal Hwy. Administration, Urban Mass Transportation Administration, and Pennsylvania Dept. of Transportation.
Availability: In HS-024 284

HS-024 293

DEVELOPMENT OF CRITERIA FOR RESERVING EXCLUSIVE BUS LANES

The reservation of an existing traffic lane for the exclusive use of buses and car pools results in increased congestion and slower speeds on the remaining lanes until a sufficient number of automobile drivers have been diverted to buses. Various transportation agencies have noted that implementation of this measure along specific corridors would impede traffic to the extent that pollutant concentrations may even increase; an analysis, therefore, was undertaken to quantify such anticipated results. Equations are developed to determine the variation of the resultant emissions with the percentage of diversion for various values of initial speed, number of lanes, and directional split (for counterflow lanes). Results of the analysis indicate that minimum diversion percentages exist below which carbon monoxide (CO) emission rates and total hydrocarbon (HC) emissions are greater with than without the exclusive bus lanes for both in-lane and counterflow configurations. Reductions in CO emissions can be achieved by means of in-lane exclusive bus lanes where average traffic speeds exceed 72 kph (45 mph) and by means of counterflow lanes where directional splits equal or exceed 55-45. Reductions in HC emissions can be achieved by means of counterflow lanes if the directional split exceeds 55-45 and the percentage of people diverted from automobiles exceeds 5%.

by C. C. Miesse
Environmental Protection Agency, Philadelphia, Pa.
Publ: HS-024 284 (TRR-648), "Environmental and Conservation Concerns in Transportation: Energy, Noise, and Air Quality," Washington, D.C., 1977 p66-70
1977
Availability: In HS-024 284

HS-024 294

HIGH STRENGTH, HIGH DUCTILITY, DUCTILE IRONS

Ductile iron has already found a place in many automotive applications (e.g. crankshafts, steering knuckles, gears), and austempered ductile irons offer an exceptional combination of high strength, ductility, and toughness, so that they can now be considered for many critical components formerly made as steel forgings or from case-carburized steels. The four steps involved in the austempering of ductile iron are heating of casting to a selected austenitizing temperature and soaking at this temperature until matrix structure has attained a reasonably uniform carbon content; cooling fast enough to prevent any transformation of austenite until castings are down to required isothermal transformation temperature; transformation to a bainitic structure until desired extent at the isothermal transformation temperature, and cooling of castings to ambient temperature, usually at a moderate rate to minimize cooling stresses. Separately discussed are austenitizing time and temperature, rate of quench, isothermal transformation, properties of austempered ductile irons, advantages of austempered ductile iron components, and future developments. Eight major advantages of austempered ductile iron gears over forged steel gears are cited: excellent machinability, longer tool life, and increased machining speeds; higher quality finish on machined surfaces; excellent resistance to scoring and wear; higher damping capacity, therefore quieter operation; shorter heat treatment cycle; less machining required; 10% saving in weight; and lower energy requirement from molten metal to finished component. The savings in machining costs alone more than justify the conversion. Carefully controlled foundry operation capable of producing castings of uniform quality and consistently high machinability is necessary. Castings that vary in matrix structure not only cause machine shop problems, but make it impossible to predict the volume changes that will occur in heat treatment. Austempered

castings may see future use in applications needing tough, abrasion resistant, and reduced weight components.

by John Dodd
Publ: Modern Casting v68 n5 p60-6 (May 1978)
1978; 15refs
At head of title: Technology for Progress.
Availability: See publication

HS-024 295

ENERGY IN TRANSPORTATION

Energy in U.S. transportation is discussed in three principal sections related to energy demand, vehicle design considerations, and energy conservation. Current and projected energy demand by the transportation modes (highway, air, rail, transit, water, pipeline) and average passenger and freight transport energy efficiencies are considered. In 1973, the total domestic transportation energy consumption was about 130 BGPA (billion gallons per annum) and the average annual demand growth was 5%. The future demand projection shows conservation initiatives now underway will cause energy consumption to level off, perhaps under 150 BGPA throughout the 1980's, even while transportation service demand continues to grow as projected for achieving economic real growth of 3%. Vehicle and propulsion systems (Otto engine, diesel engine, Brayton engine, and electric propulsion) for each of the major transportation modes are discussed, including the engine and transmission characteristics affecting the energy efficiency of current systems. Several examples of new propulsion technology opportunities to increase the efficiency of transportation fuel usage are described. Transportation energy conservation measures are discussed in terms of the projected effectiveness of the conservation initiatives now underway, plus additional opportunities that are being considered. Major fuel conservation for the automobile and light-truck fleets is projected due to the response of the automotive supply industries to the average fuel-economy regulatory programs now in effect. The projected fuel conservation for the other modes is anticipated in response to voluntary programs within the transportation supply industries, in coordination with the Federal government. Estimated upper bounds for the effectiveness of several other conservation opportunities are shown for each of the transportation modes. Fuel conservation by 1985 in terms of projected effectiveness of current initiatives and in terms of additional opportunities, respectively, is as follows (in BGPA): automobiles, 10.2, up to 14; light trucks, 4.5, up to 2; commercial trucks, 3.7, up to 2; air carriers, 2.1, up to 1; and freight trains, 0.5. Specific opportunities for 1985 in-use automotive fuel conservation (BGPA) are as follows: higher tire inflation, up to 3.0, additional lubrication improvement, up to 0.6, improved driver behavior, up to 2.0, reduced traffic congestion, up to 1.3, more car pooling, up to 1.9, buying small cars, up to 5.0, more walking and cycling, up to 1.6, more use of mass transit, up to 2.1, more runthrough piggyback, up to 0.8, and larger combination trucks, up to 0.6.

by Robert A. Husted
Department of Transportation, Office of Systems Engineering, Washington, D.C. 20590
Rept. No. DOT-RSPA-DPB-20-78-13; 1978; 44p 47refs
Availability: NTIS

HS-024 296

POTENTIAL EFFECTIVENESS OF BARRIERS TOWARD REDUCING HIGHWAY NOISE EXPOSURE ON A NATIONAL SCALE. FINAL REPORT

Calculations have been performed to assess the potential ef fectiveness of barriers in abating traffic noise from th Federal-aid highways. Noise exposure, in terms of the num bers of people exposed to Ldn (day-night A-weighte equivalent sound levels) greater than 60 dB, 65 dB, 70 dB, an 75 dB, from the primary Federal-aid system (rural routes an their urban extensions which are classified as arterial (includes Interstate System)) was computed for present traffi flow and projected traffic through the year 2000. Reductions i noise exposure were computed for four scenarios of construct ing barriers along urban interstate highways: eliminate expo sure above Ldn equals 75 dB, which requires construction o 15-ft barriers where ADT (average daily traffic) is greater tha 100K, and 10-ft barriers where ADT is greater than 30K bu less than 100K; eliminate exposure above Ldn equals 70 dB which requires 20-ft barriers where ADT is greater than 80K 15-ft barriers where ADT is greater than 30K but less tha 80K, and 10-ft barriers where ADT is greater than 10K bu less than 30K; eliminate exposure above Ldn equals 65 dB which requires 20-ft barriers where ADT is greater than 20K 15-ft barriers where ADT is greater than 10K but less tha 20K, and 10-ft barriers where ADT is greater than 3K but les than 10K; and eliminate exposure above Ldn equals 60 dB which requires 20-ft barriers where ADT is greater than 10K 15-ft barriers where ADT is greater than 3K but less than 10K and 10-ft barriers where ADT is greater than 1K but less tha 3K. It was found that significant reduction of noise exposur would require barriers along most of the urban interstat system. The benefit (in terms of reduction of exposed popula tion) per mile of barrier construction was found to be greates at high noise levels (Ldn greater than or equal to 75 dB). It i concluded that barriers would not provide a feasible metho for abating noise on a national scale. Their main benefit is t provide relief in extremely noisy local applications.

by Kenneth J. Plotkin; Vijay K. Kohli
Wyle Labs./Wyle Res., 2361 Jefferson Davis Hwy., No. 404, Arlington, Va. 22202
EPA-68-01-4374
Rept. No. WR-78-9; EPA-550/9-78-309; 1978; 25p 19refs
Availability: Environmental Protection Agency, Office of Noise Abatement and Control, Washington, D.C. 20460

HS-024 297

SMOKEY'S GUIDE TO USING A CYLINDER-LEAKAGE TESTER [AUTOMOBILE ENGINE MAINTENANCE]

The operation of and guidelines for using a compression leakage tester, or blowdown gauge, for measuring leakag from automotive cylinders are discussed and illustrated. Th blowdown gauge is a basic tool among top-flight rac mechanics, but it is not often used by mechanics who work o production cars. The tester is recommended for use for any one doing their own car maintenance. A compressed air sourc is needed, and a gauge can be purchased for under $65. Befor a tune-up or anytime trouble is suspected, a cylinder-leakag tester should be utilized. The basic steps involved in using th equipment are to hook it up to the cylinder, put each piston o top dead center (TDC) with both valves closed, put some ai in, and observe the percentage of leakage indicated by th

gauge. Normal cylinder leakage will cause deviation less than 20%; a greater reading means trouble. The path the air takes indicates what is wrong inside the engine. If the exhaust valve is not seating fully, air will escape through the exhaust. If there is a bad intake valve, air goes out the carburetor. Rings not sealing adequately let air into the crankcase and out the oil fill. A leaky head gasket can let air into water jacket, to open air, or between cylinders. A cracked head or block also allows air into the cooling system. To detect the leak source, one listens at the tailpipe, carburetor, oil-filler hole, or radiator fill.

by Smokey Yunick
Publ: Popular Science v213 n4 p116-9, 174 (Oct 1978)
1978
Availability: See publication

HS-024 298

BELTS VS. BAGS. ARE YOU SAFER WITH SELF-LOCKING SEAT BELTS OR AIR BAGS?

The development and introduction of air bags and automatic lap and shoulder belts in accordance with Federal Motor Vehicle Safety Standard 208, which mandates a phasing in of passive restraints over a three-year period for 1982 to 1984 cars, are discussed. The passive restraints must offer protection in barrier crashes of up to 30 mph. All cars with wheelbases of 114 in or more must have passive restraints by 1 Sep 1981; those with wheelbases more than 100 in and up to 114 in, one year later; and all new cars, by 1 Sep 1983. General Motors (GM), which is already offering passive belts in the Chevette, will offer airbags in some full-size cars in Oct 1980 (1981 models), before the mandatory date. Ford will offer passive belts on some 1981 models and airbags on 1982 models. GM is working on its second-generation airbags, the Air Cushion Restraint System (ACRS). Its first-generation system was offered as an option in several models from 1973 through 1976 (involving more than 11,000 cars) but was discontinued because of a lack of consumer interest, and because the downsizing of big cars in 1977 resulted in a need for a modified airbag system which was not yet production ready. The new ACRS is lighter by over 20 lb and more fail-safe than its predecessor. The 40-lb system consists of an airbag for the driver and one for the front-seat passenger; there are also knee bags to keep occupants from diving under the upper bag. The bags inflate as soon as either of two velocity-change detectors senses a crash of 12 mph or more, for frontal impacts or oblique crashes of up to 30 degrees. The GM bags will meet the 30-mph standard, but other developers (e.g. Minicars, Inc.) are creating air bags designed to protect at higher speeds (e.g. 50 mph). Questions still to be answered for air bags concern costs, reliability, effectiveness, and fail-safe performance. GM and the National Hwy. Traffic Safety Administration disagree on airbag cost. Some insurance companies claim added airbag costs will be offset by premium reductions. The airbag record is almost perfect as to reliability in deploying when needed and not deploying when not needed. Some inadvertent openings of airbags have occurred, all but one traced to servicing mistakes or willful triggering. Experts claim that there is little likelihood of injury to eyeglass wearers in a deployment, and cigarettes would probably be disintegrated by the air bag and cause no injury. Automatic belts offer automakers a more practical and less expensive way of meeting FMVSS 208. Passive belt systems are now available as an option in the VW Rabbit (belts automatically fasten around driver and passenger when door is pulled shut and must be in place for car to start) and in the Chevrolet Chevette (passive shoulder-belt, but active lap belt). Fully automatic lap/shoulder systems have been developed by GM but are not in production. The passive belts still have many of the hardware breakdown problems of the standard safety belts, but the principal drawback is that loading factors on the body are much greater than with air bags. Air bags offer better protection for the head than belts, but belts are considered to offer more protection in side impacts, rear collisions, and rollovers. In any case, passive restraints, if installed in every car, could save 9000 lives in the U.S. annually.

by Herbert Shuldiner
Publ: Popular Science v213 n4 p100-3 (Oct 1978)
1978
Availability: See publication

HS-024 299

THE USE OF EMERGENCY VEHICLES IN CONNECTICUT. A REPORT TO GOVERNOR GRASSO

Publicly perceived problems and facts relating to the use of emergency vehicles (EV's) in Connecticut were studied, and changes in statutes or policies of state authorities recommended. Among the problems were uncertainty of the meaning of the present emergency lights, causing equivocal public response, need for EV operator training, poor communications and coordination between the services, need for increased penalties for persons fleeing the police, for a police pursuit policy and for police accountability following pursuit accidents, reported police equipment deficiencies, and unnecessary emergency responses. The state motor vehicle department identified 343 EV accidents in 1975, in which six persons were killed and 298 injured. In 1976 there were 344 EV accidents, 10 persons were killed and 321 injured. Police vehicles were involved in 70% of the total accidents (52% non-pursuit, 18% pursuit). Fire vehicles were involved in 16% of the total accidents, and ambulances in 14%. Most non-police pursuit accidents occurred during daytime and at intersections. A predominant cause for at least 100 accidents in 1976 was the failure of motorists to grant the right of way. In 1975 there were 53 police-pursuit accidents in which four persons were killed, and 57 injured. In 1976 there were 73 police-pursuit accidents, three persons killed, and 79 injured. The innocent parties involved totaled 13 in 1975 and 39 in 1976. A pursuit accident occurred usually at night, at a non-intersection, and on a weekend, with dry road conditions. Testimony at a public hearing revealed that the state police department was involved in nine accidents associated with high-speed chases in 1976. It is recommended that the statutes be amended to include a new, more explicit definition of an EV and that these EV's be authorized. All authorized EV's should be required to use the same color emergency lights, in the same general location. EV's may be permitted to use more than one color light, but the color of the additional lights and positioning should be standardized, and EV's should be prohibited from using emergency lights when not on call. All service and maintenance vehicles should be grouped into a separate classification for purposes of authorizing the use of flashing lights (lights to be a color distinct from EV lights). Vehicles privately owned by volunteer fire company and ambulance service personnel should not be considered EV's, but should continue to be equipped with special flashing lights (distinct in color from those on EV's). The sole exception to the exclusivity of use of EV light color(s) should be school buses. It is recommended that EV drivers be trained in safe vehicle operation, and be

required to obtain a special operating license. Central emergency dispatch systems should be established wherever possible. The state motor vehicle laws should be expanded to include a differentiation between simply failing to stop promptly for an officer, and consciously attempting to flee. Additions should be made to statutes to define police pursuit, and to require informing a supervisor upon initiating pursuit, supervisory control over pursuit, and clearer guidance during pursuit. Every police department should adopt a specific, detailed pursuit policy. A comprehensive public education program on the use of EV's is recommended.

by Nelson Douglas; Gregory Futoma
Connecticut Safety Commission
1978; 40p 5refs
Availability: Corporate author

HS-024 300

THE COST OF ROAD ACCIDENTS. PAPERS AND REPORT FROM A WORKSHOP, 1ST MARCH 1977, WELLINGTON, N.Z.

Two reports on the cost of road accidents in New Zealand are presented along with discussion and subsequent comments arising from a one-day workshop based on the reports. In 1975 the National Roads Board commissioned Victoria Univ. of Wellington and Waikato Univ. to undertake research into the cost and incidence of road accidents. The project was promoted by the Administration Com. of the Road Res. Unit whose field is economics, finance, and administration. The Committee desired to promote cost-effectiveness methodology as a means of selecting improvement projects undertaken by road authorities. The Waikato Univ. portion of the project was presented to the Administration Com. in 1976 in a paper entitled "The Economics of Road Accidents"; early in 1977 the Victoria Univ. paper entitled "Accident Patterns, Cost Measurement and Safety Policy" was submitted. Condensed versions of these reports are presented, as well as introductory papers on accident data and accidents and the road engineer, and a list of workshop participants.

National Roads Board, Road Res. Unit, Wellington, New Zealand
Rept. No. RRU-Bull-38; 1978; 102p 37refs
Includes HS-024 303, HS-024 304, HS-024 212 and HS-024 213.
Availability: Corporate author

HS-024 301

THE DESIGN CONCEPT OF AN INTEGRAL POWER STEERING SYSTEM FOR HEAVY DUTY TRUCKS

Recently, integral-type power steering has been replacing the linkage type in Japan, and is one of the biggest current changes in steering systems for heavy-duty trucks. The change is being made in order to reduce weight, minimize space, and ease installation. Required steering gear characteristics for heavy-duty trucks are a good handling feel, adequate endurance, and easy maintenance. Handling features must include sensitive steering, smoothness, good return of the steering wheel to the straight position, and the holding of the straight-ahead position. The major design points of an integral power steering system for heavy-duty trucks, NSK Model SFP 0463, are described. This system has the following advantages: a four-way sliding valve which has an initial centering spring force so as to possess a clear straight-ahead position, a smooth steering feeling owing to a good relationship between the spring constant of the centering spring and the underlap of the spool valve, and a good return of the steering wheel due to low friction related to the rotation of the steering shaft. A belleville spring as a spring element is effective in obtaining a high spring constant and in providing a compact valve, and, at the same time, it has good handling features without losing valve response. The endurance of the oil seal related to surge pressure caused by the valve response under rough road driving must be confirmed. The new steering system has a long operating life of parts and units.

by K. Okamoto; A. Aida; I. Chikuma
Nippon Seiko K.K., Steering Gear Div. (Japan)
Rept. No. SAE-770673; 1977; 8p
Presented at International West Coast Meeting, Vancouver, 8-11 Aug 1977.
Availability: SAE

HS-024 302

A NEW COMBUSTION SYSTEM FOR THE DIESEL ENGINE AND ITS ANALYSIS VIA HIGH SPEED PHOTOGRAPHY

The characteristics of a new combustion system for a direct-injection type diesel engine, the Hino Micro Mixing System (HMMS), have been studied using high-speed photography. In order to obtain a good combustion system for direct-injection diesel engines with medium swirl, an optimum combination of the fuel-injection equipment, air-intake system, and configuration of the combustion chamber is necessary. Such a combination should provide a good geometrical distribution of the fuel jet in the combustion chamber and also good local mixing of fuel droplets and air in the fuel jets. Air turbulence induced by a newly designed intake port helps local mixing in the fuel jet of the HMMS combustion system, together with mating of fuel-injection equipment and other factors. Several types of ignition patterns were observed by high-speed photography from an underside view of the combustion chamber, enabling the simultaneous viewing of every fuel jet from an injection nozzle. The ignition and burning patterns were classified as self-ignition, impinged-ignition, diffusion-burning, induced-ignition, and scattered-ignition types. The last type, i.e. scattered ignition, was observed similarly in the supercharged combustion and in the HMMS combustion system. This pattern of ignition and burning shows more efficient combustion, due to the vigorous reaction by the micro mixing effect, which means better fuel economy with lower level of exhaust smoke.

by Takashi Suzuki; Tadakazu Shiozaki
Hino Motors, Ltd. (Japan)
Rept. No. SAE-770674; 1977; 16p 7refs
Presented at International West Coast Meeting, Vancouver, 8-11 Aug 1977.
Availability: SAE

HS-024 303

ACCIDENT DATA--THE CURRENT SITUATION [NEW ZEALAND ROADS]

The current traffic accident situation, accident reporting system, and use of accident data in New Zealand are briefly reviewed. A thumbnail sketch of the situation for 1975, the latest year for which Ministry of Transport (MOT) traffic accident data are available, is presented in statistical tables giv-

ing the age ranges of those injured and killed, accident types, types of road user involved, time of accident by day, and urban/rural breakdown of accidents. With respect to the accident reporting system, there is a requirement that all injury accidents be reported to police or MOT within 24 hours, although many go unreported (it is estimated that almost all fatalities are reported, 60% of serious injuries are reported, and 40% of minor injuries are reported); for each injury accident there are probably 5 to 10 non-injury accidents; the report processing procedures are onerous and time-consuming, information collected being a compromise between what is needed for a comprehensive analysis and what can be expected from law enforcement officers; accident data are computerized and made available to various investigations; and the size sample of accidents needed for study in order to administer adequately the total traffic safety program is still unresolved. The accident data are used by the MOT to identify the nature and magnitude of current traffic safety problems, assess the impact of traffic safety proposals, and evaluate the effectiveness of traffic safety and other related programs. Accident data are also used by educational institutions, local authorities, hospitals and researchers.

by J. B. Toomath
Ministry of Transport, New Zealand
Publ: HS-024 300 (RRU-Bull-38), "The Cost of Road Accidents," Wellington, New Zealand, 1978 p71-7
1978; 2refs
Presented at workshop held in Wellington, New Zealand, 1 Mar 1977.
Availability: In HS-024 300

HS-024 304

ACCIDENTS AND THE ROADING ENGINEER [NEW ZEALAND]

The approach a highway engineer should take in making decisions for safer roads is addressed. Accidents occur as the result of deficiency in performance of either the road, the vehicle, or the driver. Injury accidents, which are those which concern the highway engineer most, involve all three, with the road usually assuming the role of scapegoat. Accident occurrence is purely random and comparatively rare. Money spent on palliative measures at one site may be wasted unless a program to cover all similar situations is undertaken. National figures and trends are necessary for adequate prediction sampling. About 13,000 injury-producing accidents a year occur in New Zealand. The Ministry of Transport provides annual analysis of accident types, and these can be coupled with knowledge of costs to the community of minor, serious and fatal injuries. The main deficiency from the road engineer's standpoint is in assessing the benefits to be gained from remedial measures, and in knowing the effectiveness of applying other countries' measures to New Zealand. Before and after studies are seldom made. The road authority and its engineering advisors must know that funds spent are cost-effective, particularly in times of financial restraint. The proportion of road funds spent on improvements specifically aimed at reducing the number and severity of motor accidents should be increased, but factual evidence from local research is needed. Specific questions to be answered before significant road improvements are made concern the sealing of road shoulders, protecting service poles or making them breakable, clearing shoulder berms, access control on arterial roads, street lighting and signposting.

by E. J. Burt
Ministry of Works and Devel., New Zealand
Publ: HS-024 300 (RRU-Bull-38), "The Cost of Road Accidents," Wellington, New Zealand, 1978 p78-80
1978
Presented at workshop held in Wellington, New Zealand, 1 Mar 1977.
Availability: In HS-024 300

HS-024 305

AUTOMAKERS GET THE GREEN LIGHT TO INNOVATE WITH PLASTICS

Plastics applications by the U.S. auto industry to reduce weight, trim energy consumption, improve safety, and trim costs are considered. The major challenge facing the automotive industry today is meeting Federal fuel economy regulations. To improve fuel economy and hold downsizing to a minimum, weight must be reduced, and plastics can be the most effective way to do this reasonably. Typical new plastic components include instrument panels, wheel covers, headlamp housings, interior door handles and windshield wiper retainers. The easy applications have already been made, and new materials, processes and applications are being evaluated. Use of plastics has been restricted by low heat distortion temperatures, and inadequate modulus and strength characteristics, but these limitations are being overcome. Ford is working with new reinforced urethanes capable of withstanding temperatures over 300 degrees F. Other significant developments are in modified thermoplastic polyesters, polycarbonates and nylons with heat distortion temperatures over 400 F, highly glass-loaded thermoset polyesters and vinyl esters, "super-tough" nylons, structural foam plastics, and graphite-reinforced plastics. General Motors is considering a new compression molding technique which uses numerous molds instead of the traditional one to save assembly line time. Almost all automobile components are being developed in plastics. Potential applications include transmission parts, master cylinder reservoirs, disc brake pistons, intake manifolds, seat frames, bumper beams, hood panels and radiator supports. Plastics use less energy than many other materials, even when the petroleum feedstock is included, e.g. fabrication of plastics into automotive parts with traditional design thicknesses requires about half the energy used to convert aluminum sheet stock into finished parts or to make aluminum castings. Many plastics are also more energy-efficient than steel. Recycling plastic scrap can trim energy use, although thermoset plastics offer a challenge. Energy-saving research has been conducted on polymeric finishing. Plastics can enhance vehicle safety. The value of padded instrument panels and interior trim, flexible front and rear ends, is well-known. Gas tanks with unprecedented impact resistance made from high-density polyethylene, and car body structures filled with rigid polyurethane foam for impact absorption during crashes, may soon be used. Continuous-fiber reinforced plastics may be used for bumper reinforcement. Substituting plastics for metals to reduce costs is well known in Detroit, but inflationary pressures will increase the practice. Use of plastics instead of aluminum generally saves money, and in many cases plastics are cost-effective even when compared with steel. Combining several parts into a single plastic molding can cut costs, as well as using more versatile polymer systems which can be processed with high efficiency, in-house molding, reinforced plastics, and coating plastics. The substitution process

has progressed to the point where plastics which once replaced metal are being displaced by other, less expensive plastics, which do the job as well.

by Gary R. Forger
Publ: Materials Engineering v87 n2 p17-9, 22-3, 26-9 (Feb 1978)
1978
Includes: "Where Plastics are Pulling Their Weight for Automakers," "How Plastics Open the Door to More Energy Efficient Cars," "When Plastics are Used to Improve Automotive Safety," and "Which Plastics and Processes are Trimming Costs in Detroit."
Availability: See publication

HS-024 306

ARTICULATED VEHICLE ROLL STABILITY: METHODS OF ASSESSMENT AND EFFECTS OF VEHICLE CHARACTERISTICS

Nine heavily-loaded tractor-trailer combinations ranging from 32 tons to 45 tons gross train weight were driven into a rollover condition during different maneuvers in order to assess their stability in roll and the effect of different vehicle characteristics. In addition, the vehicles were first tilted sideways on a platform to the point of balance. Rollover occurred at lateral accelerations from about 0.2 g. Trailer roll was the governing factor in the overturning of the combinations tested. Multiple-turn maneuvers did not increase the risk of rollover. Increased spring stiffness, spring-base width, and coupling stiffness increased the trailer roll resistance. Measurements demonstrated that the tilt method gave a good indication of roll stability. Calculated results from a computer program of lateral acceleration required for rollover differed from the dynamic results by 10% to 40%. Rollover occurs in 3% to 4% of heavy-duty vehicle injury accidents. A higher percentage of tractor-trailers roll over compared to rigid vehicles; reasons for this are considered to be geometric layout, lack of driver awareness of the total roll of a tractor-trailer combination, and a tendency for a rigid vehicle to become self-stabilizing due to loss of drive in roll. The greatest reduction in rollover accidents might be achieved by driver acceptance that rollover is caused (other than in a collision) by too high a speed and too tight a turn. Design improvements which lower the center of gravity will improve roll performance. Increased coupling stiffness, use of a roll warning device, or roll-sensitive driver seat suspension could be used to increase driver awareness of approaching rollover.

by R. N. Kemp; B. P. Chinn; G. Brock
Transport and Road Res. Lab., Vehicle Safety Div., Crowthorne, Berks., England
Rept. No. TRRL-LR-788; 1978; 45p 8refs
Availability: Corporate author

HS-024 307

THE COST AND SAFETY ASPECTS OF QUIET TIRE USE

Significant reductions in community noise levels near highways can be achieved by simultaneously controlling vehicle engine noise and tire noise. Although solutions have been demonstrated for most of the engine-related noise sources on trucks, tire noise remains an unsolved problem at highway speeds. Although at present no more than a superficial understanding of the mechanisms of tire noise generation exists, truck tire noise reductions can be accomplished. Recently, tire wear rate and highway traction data have become available which allow evaluation of the cost and safety implications of current tire use practices and of the various alternatives to these practices that may be necessary to comply with future tire noise regulations. The data show that truck tire noise reductions can be accomplished utilizing current tire technology without adversely impacting tire manufacturers or fleet operators, if adequate changeover lead time is provided. Because of the rapid turnover rate of tires, the community noise benefits resulting from tire noise regulations can be realized in a shorter period of time following promulgation of regulations than any other major noise control tactic. From both a cost and safety point of view, the use of quieter tires provides at least equal, and, in general, advantageous performance when compared to current tire use practices.

by William A. Leasure, Jr.
Department of Transportation, Washington, D.C. 20590
Publ: Sound and Vibration v11 n2 p18-23 (Feb 1977)
1977; 15refs
Availability: See publication

HS-024 308

THE NEW SUPER OILS. THE KIND OF OIL IN YOUR CRANKCASE DEFINITELY CAN AFFECT THE DEMANDS ON YOUR POCKETBOOK

Some advances in automotive lubricants were generated by the energy crisis of 1973 and they are finding their way into consumer products. Alteration of engine oil to improve fuel economy is done by either lowering the viscosity to cut oil pumping losses and drag, or by modifying the frictional characteristics of the oil. Friction modifiers can be either chemical or mechanical in action. Chemical modifiers react with the surfaces of engine parts, lowering the friction produced when they are rubbed together. Mechanical modifiers interpose themselves between rubbing parts without any sort of chemical attraction and take the brunt of the rubbing action. Until fairly recently the use of mechanical modifiers, which are insoluble, in engine oils has been impeded by their tendency to settle out of the oil. Atlantic Richfield have apparently solved the problem in the form of Arcographite. To keep the graphite (mechanical friction modifier) in permanent suspension, use is made of an average particle size of 4/10 of a micron, as well as a dispersing aid that has an affinity for graphite particles and oil molecules. Chemical friction modifiers, on the other hand, present fewer problems when it comes to blending with motor oils, because they are soluble. However, the presence of dispersants, etc., that are part of the additive package in most motor oils, interferes with the reaction between the friction modifiers and metal engine surfaces. Reducing friction by reducing oil viscosity has some practical limitations in the case of natural petroleum oils, chiefly related to volatility (tendency to evaporate at normal and higher operating temperatures). Mobil's synthetic hydrocarbon oil, Mobil 1, does not have this problem, even though it has a much lower than normal viscosity. Mobil's claims for improved fuel economy are about 2/3 those of Exxon (Uniflo oil, with chemical friction modifiers) and Atlantic Richfield (10 extra miles per tankful vs. 16). However, claims for Mobil 1 synthetic include superior performance at extreme temperatures and 25,000-mi oil-change intervals. The latest entry into the field of gas-saving oils is Pennzoil's reformulated P-Z-L, an all-natural oil with a friction modifier in the additive package for which both extended life

and gasoline savings are claimed. Overall, the new super oils offer a savings in fuel of 4.5% when averaged over a number of cars, which is equivalent to about 3 cents/gal on 70-cent gasoline. Exxon has pointed out that if one out of 20 motorists used a super oil such as theirs, the annual savings in the U.S. would amount to 200 million gallons of gasoline.

by John Ethridge
Publ: Motor Trend v30 n10 p92-4 (Oct 1978)
1978
Availability: See publication

HS-024 309

A CHIP FOR THE OLD BLOCK. COMPUTER TECHNOLOGY WILL MAKE CARS BETTER, SAFER AND MORE EFFICIENT

The microprocessor, a silicon chip that is the heart of the microcomputer, will be used more and more in automotive applications in the near future. Computerized fuel management is nearly perfected, a process in which a microprocessor will monitor fuel mixture, spark timing, emissions, and other events, and will make adjustments to ensure optimum engine performance. Information such as mileage, average speed, fuel consumption, and estimated time of arrival, may be calculated by an on-board microprocessor and be available as digital displays on the dashboard at the push of a button. In the safety area, the computer could control braking by sensing the traction of each wheel and automatically compensating brake pressure to prevent skids, monitor tire pressure, regulate air conditioning and heating, perform anti-theft functions, detect the presence of vehicles in blind spots and prevent collisions. It could be programmed to prohibit a drunk from starting the car, to control leveling and anti-dive devices, to diagnose malfunctions, and keep a running check on lubrication levels, cooling, and parts wear. Computers will also simplify cars. Work is being done at General Motors, for instance, on a multiplexed steering-column control system using a single fiber-optic cable. Commands from switches controlling turn signals, windshield wipers, hazard flasher, key reminder, horn, headlamp control, cruise control, etc., would go to an encoder module at the tip of the column which would translate them and transmit them to a microprocessor which would decode the signals and send them to the proper power actuator. Though a few of these projected computer uses are admittedly far-fetched, the microprocessors necessary to perform them are readily available. However, sensor and control hardware is proving very difficult to develop. The automotive environment is severe and presents obstacles in the development of reliable and inexpensive electronic components and in the programming of automotive variables.

by Fred M. H. Gregory
Publ: Motor Trend v30 n10 p110-5 (Oct 1978)
1978
Availability: See publication

HS-024 310

TRIP COMPUTER IS MICROPROCESSOR-BASED [GENERAL MOTORS' DRIVER INFORMATION SYSTEM, DIGITAL DISPLAYS]

Cadillac has expanded the application of microprocessor technology to the automobile in an eleven-function driver information system using digital displays (representing the first application of such displays in an American production car). Called the Trip Computer, the system was introduced as a dashboard option on 1978 Cadillac Sevilles and is offered again for 1979. It is based on an N-channel eight-bit parallel-processing central processing unit (CPU) with expandable memory which allows changes in the moding of selectable functions. The Trip Computer has four main parts: the function select keyboard (miles per gallon, trip speed, trip time, range, destination, arrive time, rpm, temperature, volts), the CPU, the displays (fuel gallons, speedometer, and trip data), and the interconnecting special wiring. Development of the Trip Computer was aided by engineers at three of General Motors' divisions, Delco Electronics, AC Spark Plug, and Packard Electric.

Publ: Automotive Engineering v86 n10 p56-61 (Oct 1978)
1978
Based on SAE-780832 "An Expandable Microcomputer Multifunction Vehicular Information System," by Robert J. Templin.
Availability: See publication

HS-024 311

THICKNESS REDUCTION: A WAY TO MAKE WINDSHIELDS SAFER?

Vehicle sled tests (30 kph to 60 kph) using an instrumented Part 572 anthropomorphic test device (ATD) as an unrestrained right front-seat subject, and headform drop tests (20 KPH to 30 KPH), simulating elastic properties of a human skull, were conducted to evaluate the safety performance of four types of asymmetrically-laminated windshields vs. one type of standard symmetrical laminate (all VW Rabbit windshields). Current standard laminated windshields consist of two layers of 2.5-mm-thick annealed glass bonded by a plastic interlayer 0.76-mm thick. All asymmetric windshields tested had an outer-layer thickness of 2.5 mm, but with the following respective variations in inner-layer and interlayer thicknesses (in mm): 1.5 and 0.76, 1.5 and 1.14, 1.1 and 1.14, and 0.8 and 0.76. The facial covering of the ATD was modified to measure the Triplex Laceration Index (TLI). Anterior aspects of the ATD's metal headform were covered by a polyvinyl chloride (PVC) face mask molded to the contour of the headform and having the same thickness as the rubber covering removed. The PVC mask was covered by two layers of moist oil-tanned chamois. Results of the testing show that the TLI of all asymmetric windshields was lower than that of standard units. At 60 kph, the lowest TLI value was 5.2 for the 0.8-0.76 glass vs. 7.7 for the standard windshield. Thus, the TLI tends to decrease with thinner inner glass layers in asymmetric windshields; interlayer thickness variations had little effect on TLI. Likelihood of brain injury was measured by use of HIC (Head Injury Criterion) values. HIC values for all windshields were below 1000 at 48 kph, with differences between glass and interlayer thicknesses being small. Seven of the 100 vehicle sled runs involved interlayer tears, but none represented a substantial penetration. In the headform drop tests, HIC values were considerably lower for the nonfractured windshield cases when an AS15-0.76 unit was used. With a thicker interlayer, there was a slight increase in HIC and in the number of nonfractured cases. Asymmetric windshields may point the way toward lower weights and centers of gravi-

ty, while lowering both lacerative and head injury potentials in future accidents.

Publ: Automotive Engineering v86 n10 p62-6 (Oct 1978)
1978
Based on SAE-780900 "Safety Performance of Asymmetric Windshields," by Paul C. Begeman, Albert I. King, Paul Weigt, and L. M. Patrick.
Availability: See publication

HS-024 312

EXHAUST GAS REACTIVITY DEPENDS ON TYPE OF EMISSION CONTROL

Forty General Motors' cars (14 of 1970-1974 model years, 20 of 1975-1977 model years, and 6 experimental units) were tested to investigate the relationship between type of emission control device and reactivity of exhaust gases. Except for 1977 model cars, measurements of exhaust emissions were obtained according to the 1975-1978 Federal Test Procedure (FTP), but without its vehicle conditioning and evaporative emission measurement portions. Instead, the test car was driven about seven miles on either test roads or a chassis dynamometer, a day before testing; and the evaporative emission control system canister was disconnected and replaced by a purged substitute during testing. The 1977 models were tested using the full 1975-1978 FTP including vehicle conditioning, but without evaporative emission measurement. Three gas chromatographic separation methods yielded equivalent results. The nonreactive hydrocarbons (HC) include methane, acetylene, benzene, ethane, and propane. The reactive HC's include ethylene, toluene, xylenes, propylene, trimethylpentanes, n-butane, i-pentane, butenes, methylpentanes, n-pentane, ethylbenzene, and i-butane. It was found that the use of oxidation catalytic converters greatly changes exhaust HC composition. Generally, such use causes individual paraffins to increase in carbon percent and individual olefins and acetylene to decrease. Because of the large changes in HC composition, all reactivity scales evaluated indicated that converter cars produced exhaust HC mixtures less reactive than those of nonconverter cars. Reductions in reactivity/g ranged from about 10% to 35%. Thus, overall reduction in total photochemical reactivity (emissions in g/mi times reactivity/g) of exhaust HC was greater for converter cars than indicated by the percentage reduction in HC mass emissions alone. Analyses performed on experimental three-way converter cars and dual-bed converter cars indicated that exhaust from such cars was higher in paraffins, lower in olefins, and lower in reactivity than similar values from nonconverter cars. Reductions in reactivity/g, using five of the six scales evaluated, ranged from about 15% to 46%. Analyses performed on a stratified-charge engine car and a lean-combustion engine car indicated that exhausts from such cars were lower in paraffins, higher in olefins, and higher in reactivity than similar values from nonconverter cars. Increases in reactivity/g, again using five of six scales, ranged from about 13% to 31%.

Publ: Automotive Engineering v86 n10 p68-70 (Oct 1978)
1978
Based on SAE-780624 "Effect of Catalytic Emission Control on Exhaust Hydrocarbon Composition and Reactivity," by Marvin W. Jackson.
Availability: See publication

HS-024 313

UNEQUAL WALLS IMPROVE SLEEVE BEARING LIFE [HEAVY-DUTY DIESEL ENGINES]

Gould's Deltawall bearings may provide a possible key to longer heavy-duty diesel engine life. Peak oil film pressure (POFP) is the prime factor in controlling fatigue life of sleeve bearings, though it is, in turn, influenced by many other variables. Reducing bearing clearance can reduce this film pressure, but typically sensitizes the bearing to other conditions. Gould's new concept involves a simple design change which incorporates unequal walls in upper and lower shells, resulting in improved fatigue life without inducing higher temperatures, and without sacrificing the soft properties sleeves must have. Calculations indicate minimum oil film thicknesses are also improved, though the increase is not as great a percentage as is the decline in POFP. Among the possibilities of these performance advantages to the heavy-duty engine field are extended life, and therefore greater reliability to present engines, and higher loads for equivalent POFP values, thus uprating engines where bearing life is a problem; a return to the former 0.025 mm overlay thickness (with the thickness of the plated overlay up about 67%) to inhibit fatigue failure; mitigation of adverse conditions on bearings resulting from lower speed, high torque-rise diesels; and shorter L/D ratio bearings in new engines. Design credibility of the unequal wall bearings has been demonstrated in engine tests (including racing applications) and via centrifugal bearing test machines.

Publ: Automotive Engineering v86 n10 p74-9 (Oct 1978)
1978
Based on SAE-780782 "Improving Sleeve Bearing Fatigue Life: A New Design Concept," by William A. Yahraus.
Availability: See publication

HS-024 314

RELIABILITY DICTATES AUTO ELECTRONICS USES

Developing high-reliability automotive electronic components may be the single pacing factor in the long-awaited effective volume application of automotive electronics. Often, use of electronics in the automobile promises nearly 100%-optimized solutions to replace the typically 70%- to 80%-effective functions of the mechanical hardware it might replace. But 100% performance will not be enough if accomplished with any less reliability than that offered by simple nuts and bolts. Reliability requires comprehensive knowledge of the interactions of environmental stresses vs. ability of the design, its materials and processes, to withstand them. Selection and specification of electronic componentry are major decision points. Use of standard parts is highly desirable, but today there is no such thing as a uniform standard part suitable for all critical automotive applications. Often custom parts are essential, but they greatly compound the problem. A great deal of the reliability burden improvement, that of adequate and realistic component specifications, lies with individual vehicle manufacturers. Each needs the help and cooperation of the electronic component manufacturer. An embarrassing number of problems are being detected during vehicle rather than laboratory testing. Reliability can be predicted by accumulating data from field experience, by the use of analytical techniques and from accelerated life testing. Data from field testing is best, but not readily available because of the need to meet legal deadlines. Handbook calculations require a mature data base, and lag behind technology by five or more years. Life testing

normally produces generic failure rate using the Arhennius equation to extrapolate from a dry, non-cycling temperature and voltage stress environment. Extrapolation accuracy must be improved and realistic modifiers developed to include the effects of environmental conditions. Even at current levels of large-scale-integration (LSI) complexity it is virtually impossible to test each part sufficiently to approach a 100%-functional confidence level. The automotive industry cannot afford to be a far-out leader. Any process and design technology used must have a proven reliability record, substantiated with test and field data. Packaging must take into account environmental severity, high reliability, and available space. To achieve the necessary reliability levels, two basic changes are needed. Manufacturers of electronics who presume their engineers alone know what is best for the product must reappraise this attitude in light of recent developments, and the automotive community must become more knowledgeable and progressive so that timely beneficial changes can be made. The key words are open communications, cooperation and discipline between supplier and customer, for both materials and processes. Automakers must be willing to pay for the extra cost of the reliability they demand.

Publ: Automotive Engineering v86 n10 p80-3 (Oct 1978)
1978
Based on SAE-780833 "Electronic Reliability Issues Relative to Automotive Product," by J. G. Rivard.
Availability: See publication

HS-024 315

ELECTRONIC ENVIRONMENT IS IMPORTANT [AUTOMOTIVE ELECTRONICS]

Climatic, dynamic, and electrical characteristics from natural and vehicle-induced sources which influence the performance and reliability of automotive electronics are discussed. These include the effects of temperature; humidity; salt; immersion and splash; dust, sand, and gravel bombardment; altitude; mechanical vibration; and mechanical shock. Factors unique to the automobile which make the environment more severe than that encountered in most electrical equipment applications include interaction with other vehicular electronic systems, voltage variations, customer-added equipment, and lack of maintenance. Conditions fall into either the steady-state or transients and noise categories. Steady-state variations include those of applied DC voltage with a characteristic frequency below 1 Hz; transients and noise include high-voltage signal components with characteristic frequencies greater than 1 Hz. Two other environmental conditions which affect automotive electronics are electrostatic energy stored in the human body, which may cause anomalies when discharged to a device, and external sources of radiated energy.

Publ: Automotive Engineering v86 n10 p84-7 (Oct 1978)
1978
Based on SAE-780859 "Applied Automotive Electronics," by Rosslyn J. Cannon, James C. Champlin, Joseph P. Ryan, and Katherine Rima Schnepf.
Availability: See publication

HS-024 316

SYSTEMS ENGINEERING APPLIED TO ENGINE CONTROL [AUTOMOTIVE ELECTRONICS]

Conflicting performance requirements related to fuel economy and exhaust emissions have radically changed automotive design criteria, forcing engineers away from the experimental approach to focus on the pattern of interaction between various automotive subsystems as they relate to overall performance objectives. Analytic tools used in the systems engineering approach are modeling, computer analysis and graphics, computer simulation, optimization and control theory. The systems approach can reduce total design time, the amount of trial and error, and provide insight into the behavior of the system. Simplified mathematical models can be devised to define the limits of automobile performance to be expected from a given set of components using microcomputer engine controls. The closed-loop approach to control air-fuel ratio helps meet emission standards and improves reliability and driveability. Engineering proof in the form of mathematical models, equations and experimental data helps settle contested technical issues of fuel economy. Estimation algorithms, e.g. the Kalman Filter, may be used to estimate the real time variables which are not sensed, and may indicate when various components of the system, including sensors or actuators, have failed or are likely to fail. The most important aspect of the closed-loop engine control problem is sensitivity, the variability of system performance caused by changes in performance of individual components; these variations are due to production tolerances, environmental parameters, and aging effects. Design innovations to reduce sensitivity can be tested by systems engineering. Diagrams and details are presented of a study to improve driveability without degrading fuel economy and emissions, by improving dynamic coordination of the various control loops of the engine. A system known at General Motors as COMEC (Coordinated Microprocessor Engine Control) improved driveability with a multi-variable control routing the driver's accelerator input to the microprocessor.

Publ: Automotive Engineering v86 n10 p88-91 (Oct 1978)
1978
Based on SAE-780851, "Applying Systems Engineering Methods to the Electronic Engine Control Problem", by Paul F. Chenea.
Availability: See publication

HS-024 317

CRUNCH COSTS [AUTOMOBILE REPAIR]

Variations in the costs of car insurance may be partly ascribed to differences in repair costs. At the Motor Insurance Repair Res. Centre at Thatcham, Berks., England, in operation since 1970, repair methods are investigated and efforts made to influence car manufacturers to avoid constructions resulting in costly repairs. In establishing insurance premiums, cars are grouped according to performance, availability of parts, repair costs for external panels, and experience with the particular model, with repair costs accounting for some 60% of the formula. At the Research Centre, testing includes the removal and replacement of all skin panels on an undamaged car, a simulated crash on the test rig with a slave "bullet" car, and work on cars damaged in road collisions. If parts lists are based on the large sub-assemblies built up in production, repairs must be costly; the availability of part panels cuts down expense. These are available for nearly all Austin-Morris

cars, the Fiesta, Granada, Vauxhall Vivas and Chevettes, Cavalier, Chrysler Sunbeam and most Volkswagens. Volkswagen and Citroen have reduced repair costs recently in this way. Problems in replacing skin panels, difficulty of access, need for extensive welding, lack of convenient natural break lines for the paint, and trouble with a bonded-in windscreen are complications increasing labor time and therefore expense. Analysis by engineers at Thatcham of a prototype body for a new model afforded advice on potential repair problems before the tooling for the body was decided upon.

by John Hartley
Publ: Autocar v149 n4273 p48-50 (30 Sep 1978)
1978
Availability: See publication

HS-024 318

STATISTICAL ESTIMATION OF INDIVIDUAL MOTOR VEHICLE DRIVER'S ACCIDENT LIABILITY BASED ON AN ANALYSIS OF THE MEAN TIME INTERVALS BETWEEN ACCIDENTS OF GEORGIA DRIVERS

Several statistical estimators useful in the estimation of the mean time interval between an individual motor vehicle driver's accidents or citations are compared and evaluated, using data from 50 Georgia motor vehicle drivers with one or more accidents. The three estimators suggested by Sichel in 1971 are presented and discussed; modifications of one are presented. A Bayesian approach is set forth and analyzed. A final discussion of the assumptions and the estimators and their reliability is presented. It is concluded that both the Bayesian estimates and Cox's approximation minimum length estimates (somewhat less well than the Bayesian estimates) for drivers with at least two accidents provide satisfactory reliability and, therefore, some measure of discrimination between drivers with different accident liabilities.

by W. O. Williford; G. R. Murdock
Publ: Accident Analysis and Prevention v10 n3 p189-205 (Sep 1978)
1978; 14refs
Availability: See publication

HS-024 319

THE INFLUENCE OF DAYLIGHT SAVING TIME ON MOTOR VEHICLE FATAL TRAFFIC ACCIDENTS

It is shown that Daylight Saving Time (DST) reduces fatal traffic accidents involving motor vehicles by approximately 1.0% during several weeks at the spring and fall DST transitions. There is also a net reduction of about 0.7% during the DST period Mar and Apr 1974, compared to the non-DST period Mar and Apr 1973, but little net DST effect on fatal accidents in the winter. The basic method employed to obtain this estimate of the effect of DST on motor vehicle accidents is to compare numbers of persons killed in these accidents during both DST and non-DST periods by identifying high frequencies in the Fourier spectrum of traffic fatalities which are relatively sensitive to DST, and then using a bandpass filter to remove low frequency components not associated with DST. A cause/effect relationship between DST and fatal traffic accidents is then established by measuring changes in the filtered time series of fatality data across DST transitions, and across non-DST or control transitions. Certain statistical criteria are then applied to these measurements in order to confirm the existence of a DST effect on fatal traffic accidents and resulting fatalities. The principal deficiency in the data base used was that it included very few DST transitions; a study of additional transitions is recommended, including low frequency data, less resonances. The effect of DST on non-fatal motor vehicle accidents and related injuries should be assessed; Fourier analysis and digital filtering should be used to identify nationally representative motor vehicle trends; and each of these areas should include an analysis of biases that may exist in the raw data.

by Norman J. Meyerhoff
Transportation Systems Center, Kendall Square, Cambridge, Mass. 02142
Publ: Accident Analysis and Prevention v10 n3 p207-21 (Sep 1978)
1978; 11refs
Availability: See publication

HS-024 320

AN ANALYSIS OF NIGHTTIME PEDESTRIAN ACCIDENTS AT SPECIALLY ILLUMINATED CROSSWALKS [ISRAEL]

A before and after study was made of the effect of the special crosswalk illumination and signing system presently warranted for use in Israel. The fixture was treated as an entirety, without attempting to distinguish between differential effects of the sign and of the illumination provided on the crosswalk. Ninety-nine installations were studied where no other engineering changes had been made in the "after" period. It was found that a significant reduction in pedestrian night accidents was achieved where the installations were made, while the reduction in day accidents was not statistically significant. In addition to the analysis of night and day accident changes at sites where the system was installed, comparison was made between a number of these sites and a group of unlit "control crosswalks", each of which either adjoined the lit crosswalk at the same intersection or was nearby on the same street. Accidents at these control crosswalks did not show a significant change over the period studied. Additional factors which were investigated, such as pedestrian and vehicle flow, weather, and national trend of pedestrian accidents, all supported the conclusion that it was the installation of the sign and lighting system which brought about the observed reduction in accidents. The system was found to represent a highly worthwhile investment in terms of costs and accident reduction benefits. Further research is suggested on the relative contribution to total effects of the sign and of the illumination provided on the crosswalk, on the optimal illumination required, and on improved maintenance methods.

by Abishai Polus; Allan Katz
Publ: Accident Analysis and Prevention v10 n3 p223-8 (Sep 1978)
1978; 10refs
Availability: See publication

HS-024 321

HUMAN FACTORS IN LEVEL CROSSING ACCIDENTS [RAILROAD CROSSINGS, AUSTRALIA]

To establish the factors that influence human behavior at road/rail crossings, a study was made in Victoria, Australia,

concentrating on crossings protected by flashing lights in major urban areas and on "open" crossings, protected only by signs and with no form of active device, in rural areas. These types of crossings were chosen because 80% of road/rail crossing fatalities in Victoria between 1969 and 1974 occurred at these crossings. Brief descriptions of the four principal types of grade crossings (gates, boom barriers, flashing lights, and open crossings) are provided. It was concluded that the stimulus afforded by twin alternating flashing lights is inadequate for many road vehicle drivers, already overloaded by the complexities of the major urban road traffic systems. The absence of advance warning signs on one or more approach roads to the majority of crossings surveyed in a rural field study is thought significant. Many drivers are accustomed to an active device notifying the approach of a train, in addition to a preliminary sign, and fail to observe caution; a two-stage warning system is therefore indicated. At crossings where advance warning signs are provided, the one most frequently used, the Railway Crossing Warning Assembly, with silhouetted crossbucks and flashing lights, is deemed inappropriate as it permits ambiguous interpretation and, unless used uniformly, does not stimulate the desired response.

by E. C. Wigglesworth
Publ: Accident Analysis and Prevention v10 n3 p229-40 (Sep 1978)
1978; 12refs
A summary of a longer report prepared for and supported by the Ministry of Transport, Vic., Australia.
Availability: See publication

HS-024 322

SLEEPY DRIVERS: ANALYSIS AND THERAPY OF SEVEN CASES [SWEDEN]

Seven car drivers with frequent problems of staying awake while driving were studied, and their cases are detailed. As an alternative to the usual drug therapy, a behavioral treatment was tried, consisting of training in active driving and covert conditioning of alertness responses. Therapy was aimed at breaking the chain of overt behaviors leading to sleepiness by introducing self-control responses. Follow-up after six and 24 months indicated that for six of the subjects the sleepiness while driving had diminished considerably. In a pseudo-control group of five, four subjects were unaltered. Background data favored a conditioning explanation of drowsiness while driving for four of the subjects in the therapy group. The behavior analysis also showed that some of the subjects had difficulties in staying awake in other monotonous situations; three might be diagnosed as narcoleptics. Learning principles are efficient in advising treatment methods for drivers affected by drowsiness behind the wheel, and might be applied to similar difficulties in other tasks, e.g. pilots.

by Karl-Olov Fagerstrom; Hans-Olof Lisper
Publ: Accident Analysis and Prevention v10 n3 p241-50 (Sep 1978)
1978; 20refs
Supported by Transport Res. Delegation, Sweden.
Availability: See publication

HS-024 323

USE OF MULTIDIMENSIONAL UTILITY FUNCTIONS IN HAZARDOUS SHIPMENT DECISIONS

Recent developments in multiple-objective decision analysis are utilized to assess the applicability of the theory to decisions in hazardous material shipments. A realistic problem involving decisions related to the shipment of anhydrous ammonia by different transportation modes is formulated and solved utilizing decision theory. Steps taken are: structure the problem by determining the objectives (minimize human deaths, environmental damage); determine a quantitative performance measure for each objective so they are operationally defined; define the set of possible strategies or policies that could conceivably achieve the objectives; from engineering and economic studies, determine the range of possible effects that could result from the various strategies and the likelihood of each of these possible consequences; and assess the decisionmaker's performances among all the various consequences, quantify them, and determine which decision will result in the greatest overall acceptability. The methodology presented, making use of multi-dimensional utility functions, can be a useful aid in choosing optimum strategy. Issues limiting its applicability in some situations are the lack of certainty equivalents to probable occurrences in terms of human exposure impact evaluations; the unavailability of detailed information on accident and spill rates for specific chemicals over different transportation routes and modes; and problems in converting spill volumes (on land or water) into extent of damage to people, property and the environment.

by Ashok S. Kalelkar; Robert E. Brooks
Publ: Accident Analysis and Prevention v10 n3 p251-65 (Sep 1978)
1978; 8refs
Availability: See publication

HS-024 324

TWELVE STATE-OF-THE-ART INDIVIDUAL ELECTRIC AND HYBRID VEHICLE TEST REPORTS. VOL. 1

Detailed information regarding the state-of-the-art assessment of electric and hybrid vehicles is presented in individual reports on 11 specific vehicles selected for test and evaluation because of their ready availability and their technical representation and apparent maturity of construction. The vehicle tests and data provided are in support of Public Law 94-413 enacted by Congress on 17 Sep 1976, requiring the Energy Res. and Devel. Administration (ERDA) to develop data characterizing the state-of-the-art of electric and hybrid vehicles. The data so developed are to serve as a baseline to compare improvements in electric and hybrid vehicle technologies, to assist in establishing performance standards for electric and hybrid vehicles, and to help guide future research and development activities. Results of tests, conducted in accordance with ERDA Electric and Hybrid Vehicle Test and Evaluation Procedure based on SAE J227a test procedure, are presented for the following vehicles: C. H. Waterman DAF electric passenger vehicle, AM General DJ-5E Electruck electric delivery van, C. H. Waterman Renault 5 electric passenger vehicle, EPC Hummingbird electric passenger vehicle, Battronic Minivan electric delivery van, EVA Contactor electric passenger vehicle, EVA Change-of-Pace Coupe electric passenger

vehicle, Zagato Elcar electric passenger vehicle, Power-Train electric delivery van, Volkswagen Transporter electric delivery van, and Kordesch hybrid passenger vehicle. In addition, results are presented for tests conducted on four conventionally-powered vehicles (a conventional Volkswagen Transporter, a Renault 5, an American Motors Corp. Pacer, and a Postal Service American Motors General DJ-5 delivery van) according to the electric vehicle test procedure.

National Aeronautics and Space Administration, Electric and Hybrid Vehicle Proj. Office, Lewis Res. Center, Cleveland, Ohio
IA-EC-77-A-31-1011
Rept. No. HCP/M1011-03/1; UC-96; 1978; 705p refs
Availability: NTIS $21.50 printed copy, $3.00 microfiche; GPO, stock no. 061-000-00135-2

HS-024 325

ARIZONA TRAFFIC ACCIDENT SUMMARY

Based on data furnished by Safety Projects Services, Traffic Engineering Section, this report summarizes traffic statistics for Arizona in 1977. Urban deaths were up 41% and pedestrian deaths up 28%; there were more fatalities in rear-end collisions and angular crashes at intersections. As many were killed in school bus accidents (4) as died similarly in the last five years. Total vehicle miles traveled rose by 7.1%, total accidents by 10% to a record 75,769. Detailed tables are provided for Arizona accident statistics 1925-1977; Arizona accident data for 1977 compared with 1976; 1977 annual record; motor vehicle registration, involvement and licenses; economic losses by counties; national accident facts; type and number of accidents by location (county, cities and towns, type of road, whether alcohol-related, resulting injuries or fatalities, in national parks, Indian reservations); accident information (citations by jurisdictions, hour of day, day of week, by month, type of accident by first harmful event (state, urban, rural), vehicle action (first harmful event), directional analysis, type of vehicle involved, multi-vehicle accidents); drivers in accidents; drivers and vehicles in fatal and non-fatal accidents (age, sex, physical condition of drivers, residence, teen-aged, hit and run); age distribution; accidents involving drinking drivers; pedestrians; motorcycle, motorscooter and moped accidents; pick-up and other truck accidents; light and weather conditions; road information; and school bus statistics.

Arizona Dept. of Transportation, Governor's Office of Hwy. Safety
1977; 33p
Availability: Corporate author

HS-024 326

PASSENGER CAR FUEL ECONOMY IN SHORT TRIP OPERATION. ALTERNATIVE FUELS UTILIZATION PROGRAM

To assess the benefits attainable from a gasoline blended to provided improved short trip fuel economy, a test program was devised, consisting of a factorial test design in combination with an analysis of variance to study the fuels in small and large cars, with fuel injection and with carburetion, and at ambient temperatures of 0 degrees and 90 degrees F. An all-weather chassis dynamometer with precise temperature control was used. The driving cycle consisted of a three-stage test: following a specified soak period, the vehicle was started and operated over a short repetitive driving cycle for about seven miles, followed by 505 seconds of the Environmental Protection Agency (EPA) driving schedule referred to as the hot transient run; the final phase is a repetition of three of the driving cycles used at first, to establish a comparative value for warmed-up conditions. The factorial test design was used to compare typical seasonal fuels with a special fuel developed to better establish the effect of fuel gravity on fuel economy. Fuel effects are presented in detail and show that whenever a significant difference between fuels is detectable, the special fuel gives improved economy. The high levels of significance of 99% or more obtained in the analysis of variance support the accuracy of the test procedure. It was found that some cars are much more fuel efficient in short trip operation than others. The small cars with manual transmissions selected are more fuel efficient in short trip operation than large cars with automatic transmissions. Cars with fuel injection have poorer fuel economy at low ambient temperatures. The effect of low ambient temperatures continues to show up in reduced fuel economy even on longer trips, and factors other than fuel must be considered. The fuels used were within the range of typical fuels and could not be used to establish a true minimum base line. It is recommended that future programs adhere to the practice of statistically designed tests; that short trip economy at cold ambient conditions be carefully evaluated; that the effect of automatic transmissions be fully studied; that the new fuel injection systems be fully evaluated in short trip operation at cold ambient conditions; and that additional gains at warmed-up conditions but at low ambient temperatures be studied. It is further recommended that programs be developed to study fuel effects with improved choke or fuel injection enrichment control; that a true base line for short trip operations be established; and that the fuel requirements for alternative engines designed for short trip operation be evaluated as the engines become available, with studies initiated to evaluate diesel engines and fuels in short trip operation, especially at low ambient temperatures. Appended are a detailed illustrated description of the all weather chassis dynamometer, an explanation of the testing procedure, and tabulated data from the tests.

Gulf Res. and Devel. Co., Pittsburgh, Pa.
DOE-EC-77-C-02-4248
Rept. No. HCP/W4248; UC-96; 1978; 69p 11refs
Availability: GPO, Stock No. 061-000-00112-3

HS-024 327

THE COMMERCIAL VEHICLE INDUSTRY IN OHIO: ECONOMIC IMPACT AND FUTURE PROSPECTS

The commercial vehicle (c.v.) industry is a major growth component of the industrial sector of Ohio's economy. Commercial vehicles include trucks, truck tractors, vans, buses, and utility vehicles in classes one through eight (light through heavy-duty). The production of c.v.'s and related parts, accessories, bodies, and equipment accounts for about 5.5% of the value of all factory shipments in Ohio. The industry profile, employment in the industry, industry growth, productivity, survey of industry perspectives, growth potential, and policy implications are separately considered. It is concluded that the c.v. industry is likely to continue its growth in Ohio, but that the period of extraordinarily rapid growth may have ended. Since 1972 the growth rate has slowed. Given the product mix of the finished c.v. industry in Ohio, its future will be tied closely to the growth in demand for vans, light trucks, and four-wheel drive utility and recreational vehicles. At present it

does not appear that massive tax or financial programs by state or local governments are either warranted or necessary. What is required is a prudent approach to the manufacturing sector that creates a generally favorable economic environment. The long-term health of the c.v. industry in Ohio may well depend on productivity improvement. The state should consider serving as a catalyst to establish a joint effort of management, labor, and government on the issue of productivity. Suggested topics for consideration by this joint task force include overall labor-management relations and means of handling labor disputes; work rules and their effects on both productivity and the work environment; the responsibility and role of management in improving productivity through added investment; and the role of the state in maintaining a sound economic environment.

by Robert R. Ebert
Publ: Bulletin of Business Research v53 n2 (Feb 1978)
1978; 8p refs
Availability: See publication

HS-024 328

TRANSPORTATION, STRESS, AND COMMUNITY PSYCHOLOGY

Conditions of transportation were investigated as sources of psychological stress as they affect the physiology, task performance, and mood of commuters. Participants in the study were 100 employees of industrial firms. Traffic congestion was construed as a behavioral constraint in terms of the concept of impedance which is defined by the parameters of distance and time. It was expected that the effects of impedance would be mediated by personality factors, such as locus of control. Multivariate tests of the internal validity of the impedance factor were significant. However, significant main effects for impedance were obtained only for mood and residential adaptation. The predicted interactions of impedance with locus of control were obtained across task performance indices. In multiple-regression analyses, the distance and speed of the commute to work were found to account for significant variation in blood pressure, while several indices of personal control had significant regression effects on the task measures. The project has indicated an important area for research in community psychology. If community psychology is to be concerned with the study of environmental forces which impact on the adjustment of persons and communities, it must do more to investigate areas like transportation and other aspects of the physical environment that influence health and behavior.

by Raymond W. Novaco; Daniel Stokols; Joan Campbell; Jeanette Stokols
University of California, Irvine, Prog. in Social Ecology, Irvine, Calif. 92717
Rept. No. UCI-ITS-SR-78-2; 1978; 42p 39refs
Funded by Inst. of Transportation Studies, Univ. of California, Irvine, Calif. Accepted for publication in American Journal of Community Psychology. Presented in part at 85th Annual Convention of American Psychological Assoc., San Francisco, Aug 1977.
Availability: Corporate author

HS-024 329

DRIVER'S GUIDE

A summary of the laws and rules that apply to all persons who drive in the state of Washington is presented. Abundant color illustrations accompany the text which is divided into the following sections: driver licenses, rules of the road, traffic signs and signals, special driving situations (e.g. freeway driving, night driving, bad weather), emergency situations (defensive driving, emergencies), vehicle equipment, special vehicles (bicycles, trailers), motorcycles, driver records, alcohol and other drugs, financial responsibility, implied consent law, vehicle registration and title, and ten tips from the professional driver.

State of Washington, Dept. of Licensing
197?; 64p
Availability: Corporate author

HS-024 330

AUTO FUELS OF THE 1980's. 1ST ED.

In many regions of the U.S. the most commonsense source of future automotive fuel is coal-seam methane. The millions of cubic feet of methane produced daily by coal seams are being wasted by irresponsible coal corporations and narrow-minded state and Federal governments. The U.S. has nearly as much methane in coal seams as it has natural gas, about 850 trillion cubic feet. The "methane belt" stretches from southeastern Pennsylvania to southeastern Utah, with the greatest concentration in the Appalachian region. When other forms of energy run low, the gassy mines of North America could provide refueling stations for vehicles traveling coast to coast. As an automotive fuel, coal seam gas can be used three ways: as straight compressed gas (LNG), by turning it into methanol and mixing it with gasoline, and by burning it as pure methanol. It is conceivable that passenger vehicles, using LNG, gasohol, and methanol, could travel across the U.S. without stopping at a multinational-owned service station. The two basic ways to extract methane from a coal mine are by drilling vertical holes into the seam from above and pulling the gas up to storage tanks, and by horizontal "borehole" drilling directly into the coal seam and pulling the gas back to the coal face. The most critical problem occurs at the coal face when large amounts of methane are freed by the continuous mining machines, and advanced methane removal techniques are required to provide safety. To continue to blow it out is suicidal and a waste of a natural resource. The only advantage gasoline has over methane as an automotive fuel is that it does not have to be compressed. Advantages of methane include clean burning, safety in use, as good or better fuel efficiency as gasoline, extended engine life, and reduced maintenance costs. The main problem preventing extraction and marketing of coal-seam methane is ownership. All past and many present coal leases do not make provision for coal-associated methane. If Congress would declare methane a national public resource, the methane question would not get bogged down in litigation. Money should be appropriated to set up methane service stations at each gassy mine. Depletion of petroleum fuels, price gouging by monopoly oil companies and international intrigue may encourage methanol use sooner than expected. Distribution problems will limit initial automobile use to fleets and regions where travel is limited and gasoline refineries scarce. The first use will probably be in blends of 10-20% methanol to 80-90% gasoline. When supply and distribution problems are solved its use as a pure fuel will become practical. The most

promising sources of future automobile grade methanol are coal seam methane, biomass, and photosynthesis. Oil and auto industry lobbyists oppose efforts to fund methanol research and use.

by Jack Frazier
1978; 67p refs
Availability: Solar Age Press, Indian Mills, W. Va. 24949 $3.95

HS-024 331

SOME NEW THOUGHTS ON BICYCLE SAFETY EDUCATION, OR AXIOMS TO GRIND

Since the majority of existing educational programs in bicycle safety have not been examined in 20 or more years, they should be reexamined and redirected to respond adequately to the real needs of the children addressed. The new approaches, technology, and enthusiasm that have accompanied the increased adult interest in bicycling during the last decade have not focussed on children. One reason for program stagnation as far as children are concerned could be related to a major difference between adult and child cyclists. When adults became interested in bicycling, they literally took over the show; they knew what they wanted in terms of facilities, equipment, and information, and they are getting it. A review of several hundred bicycle safety programs, films, instructor's manuals, etc., has demonstrated three common characteristics which must be eliminated in order to make educational programs more responsive to the true needs of the child bicyclist. The concept of the bicycle as a mode of transportation, not merely as a plaything, necessitates some changes in bicycle safety education programs. School programs should teach bicycle safety, not how to ride a bike. The role of the school in developing proper attitudes and skills on the part of the child and the purpose of humor in education need to be examined. Since bicycling is viewed as a play activity, most educational programs present information to children in a humorous format, in the belief that children will learn only if there is a gimmick involved. The possibility that learning itself could be enjoyable is overlooked. At the individual program level, the task to improve bicycle safety education programs involves three distinct operations: user contact, program review, and program modification. Probably the biggest flaw in most programs is that there was no developer/user contact; children need to be consulted. When a sense of how the different age groups view their bicycles has been obtained, the next step is to examine an education program that is being used, developed, or under consideration for purchase. Sensitivity has to be used to judge the overall tone of a program as well as specific words or activities.

by Colette O'Leary
Publ: Bicycle Forum n2 p14-5, 50 (Fall 1978)
1978
Availability: See publication

HS-024 332

THE EFFECT OF EFFECTIVE CYCLING [BICYCLING EDUCATION COURSE]

The Effective Cycling curriculum and instructor certification program, endorsed by the League of American Wheelmen and available nationwide, creates competent cyclists by teaching the necessary knowledge, by developing the necessary skills, and by addressing attitudes. The program, designed for cyclists 14 years of age and older, employs a 30-hour course comprised of about 10 hours of classroom work and 20 hours of cycling, including several hours in very heavy, fast traffic. The course objective is to enable the cyclist to use a bicycle every day, for every purpose, whatever the terrain, weather, or traffic conditions. Effective Cycling combines bicycling theory, maintenance, repair, and riding technique instruction with a strong emphasis on practical on-the-road, on-bike training. Each class spends substantial time putting theory to practice as students take to the road on bicycles, under the instructor's close supervision. The course addresses the complete spectrum of cycling experience, from commuter riding to time trailing and bicycle camping.

by John Forester
Publ: Bicycle Forum n2 p17-9 (Fall 1978)
1978; 4refs
Availability: See publication

HS-024 333

FROM COUNTERMEASURES TO CONSPICUITY. BICYCLE FORUM INTERVIEWS KEN CROSS [BICYCLE SAFETY RESEARCH]

Ken Cross, the author of the National Hwy. Traffic Safety Administration's (NHTSA) study of Bicycle/Motor Vehicle Accident Types (a four-year study identifying 37 accident types, grouped into seven general classes), expresses his views on bicycle safety in a question-and-answer format. The NHTSA study led Cross to many provocative observations about bicycle education, safety, facilities, and legislation as reported in this interview. Included are the views that there is not a very high correlation between the ways bicyclists have assumed car-bike accidents occur and the way they actually occur; that there is a lack of good, empirical data on the relationship between exposure and accidents; that extremely few fatalities result from wrong-way riding, but many injuries; and there is reluctance by bicyclists to look behind because of fear of falling down. Children are without a spokesperson at meetings where community bicycling decisions are made; there are other things to be taken care of first before bike lanes; a comprehensive educational program, above all other countermeasures, is necessary to make an impact on the bike accident problem; and it is better for lighting standards to be defined in terms of conspicuity than visibility.

by Peter Drake, ed.
Publ: Bicycle Forum n2 p22-7 (Fall 1978)
1978; 1ref
Availability: See publication

HS-024 334

SAFETY PLUS REGS. A VITAL RELATIONSHIP [TRUCKING INDUSTRY]

A recent nationwide survey of thousands of intercity truck drivers in the U.S. indicates that, in most cases, safety and compliance with trucking regulations increases with the degree of economic regulation of the carriers and the degree of control exercised by the trucking company over the driver. The survey was sponsored by the California Trucking Activities Inc., Regular Common Carrier Conference, Union 76, the Teamsters, Assoc. of American Railroads, United Parcel Service, and Harvard Univ. The survey revealed that over 10% of the drivers of the exempt carriers (those that haul exempt

commodities, such as unprocessed food, and are not subject to any economic regulation) regularly use pep pills to stay awake while driving, in contrast to 0.2% of the drivers for common carriers (those that are subject to the most economic regulation). The survey reports that nearly 1/2 of the company-employed drivers for exempt carriers report they regularly drive beyond the 10-hour limit, and that 1/3 use multiple log books to circumvent hours-of-service rules. Only 2.48% of the company drivers of common carriers said that they regularly violate hours-of-service regulations, and less than 2% reported using multiple logs. The cruising speed for company drivers of exempt haulers was found to average 63 mph vs. 58.85 mph for common-carrier drivers. Data concerning moving violations indicate a similar trend, an average of 1.33 moving violations per 100,000 miles for exempt owners-drivers vs. 0.41 violations per 100,000 miles for common-carrier drivers. The results show that continued economic regulation would be in order, and raise serious questions about the unregulated sector. The survey results often conflict with data published by the Bureau of Motor Carrier Safety, in part because the unregulated sector underreports accidents.

Publ: Fleet Owner p95-7 (Aug 1978)
1978
Availability: See publication

HS-024 335

THE CALCULATION OF THE VIBRATIONS OF A FOUR-WHEELED VEHICLE, INDUCED BY RANDOM ROAD ROUGHNESS OF THE LEFT AND RIGHT TRACK

When applying the known power spectra of the random road roughness to the suspension behavior of a four-wheeled vehicle, each of the four vertical input signals, as well as their interdependence, must be considered. A calculation procedure is explained for the determination of the excitations to which such a vehicle is exposed, as well as the resulting vehicle responses (bounce, pitch, roll, and torsional vibrations). The calculation method is applied to several vehicles characterized by different design parameters. In the case of a four-wheeled vehicle, the excitation input is complex, since it occurs at four different places (wheels), and the responses of the vibrating system differ in quantity and quality, and are sometimes even opposite to each other. By means of a three-dimensional simulation model, the values of the random vehicle vibrations are calculated, and the influence of vehicle speed, waviness exponent, track width, wheel base, and axle design features are determined, in addition to the relationship between the vertical vibrations and the reference point in the vehicle body. The sample calculations show that the bounce responses start playing a dominant role only at speeds above 50 km/h for the wheel displacement, and above 100 km/h as far as the dynamic load is concerned. For vertical accelerations (reference point located on the body above the wheel) the roll vibration is greater for speeds of up to 125 km/h and more, due to the generally hard roll springing and anti-roll bars. This shows the limits to suspension analysis. The design parameters must not be chosen only on the basis of vertical dynamic requirements, but also on the lateral and longitudinal dynamics. The increase in track width and wheel base alone, will hardly improve suspension behavior. Nevertheless, this is a criterion for designing comfortable vehicles as it facilitates compromises imposed by the requirements of active vehicle safety (stability in braking and cornering). The three-dimensional suspension simulation proves that rigid axles do not result in serious disadvantages, if the spring and damping rates are properly adjusted, and provided the unsprung mass does not increase excessively. The mathematical approach also permits calculation of the excitation of six-wheel or eight-wheel vehicles or of those with more than two tracks, such as tricycles. It is also possible to calculate forces acting in the shock absorbers or wheel suspension, as well as stresses in body structures.

by G. Ruf
Publ: Vehicle System Dynamics v7 n1 p1-23 (Jan 1978)
1978; 7refs
Availability: See publication

HS-024 336

EFFECTS OF OPERATIONAL AND DESIGN PARAMETERS ON THE SEQUENCE OF LOCKING OF THE WHEELS OF TRACTOR-SEMITRAILERS

Loss of directional stability during braking occurs in many road accidents involving tractor-semitrailers. To minimize the undesired directional response, the correct order of locking of the wheels is important and should receive greater attention. An examination is made of the effects of operational and design parameters on the sequence of locking of the wheels of tractor-semitrailers, in order to provide the operator with easily understood guidelines for the proper control of operational parameters, such as payload distribution on the semitrailer, to minimize the undesired directional response of tractor-semitrailers equipped with conventional brake systems. It is also intended to provide the designer with guiding principles for the proper selection of design parameters of tractor-semitrailers to achieve the optimum sequence of locking of the axles. It is shown that for a given tractor-semitrailer with a particular brake force distribution, it is not always possible to achieve the optimum locking sequence under all possible loading and road conditions by controlling the operational parameters alone. However, by proper selection of the design parameters together with appropriate control of the operational parameters of the tractor-semitrailer, it is possible to achieve the optimum locking sequence of the wheels over a wide range of loading and road conditions. Even when heavy commercial vehicles are equipped with antilock devices, ensuring optimum locking sequence by proper design of the braking system should still receive careful consideration, since, in the event of antilock failure, undesired directional response of the tractor-semitrailer can be minimized if the wheels lock in the correct sequence.

by J. Y. Wong; R. R. Guntur
Publ: Vehicle System Dynamics v7 n1 p25-47 (Jan 1978)
1978; 6refs
Availability: See publication

HS-024 337

THE EFFECTS OF LOCAL KNOWLEDGE AND SIGHT RESTRICTIONS ON DRIVER BEHAVIOR AT OPEN RAILWAY CROSSINGS

Drivers' head movements and mean approach speeds were studied at an "open" railroad crossing, i.e. a crossing protected by a static array of signs and with no automatic device warning of an approaching train, in order to assess the effects of local knowledge and sight restrictions on behavior. At the study site, rail traffic consists of a freight train that makes a return trip between two cities three days a week. The out-

standing feature of this crossing is that there are unobstructed sight distances on three of the four quadrants; but on the southeast quadrant, there is a double row of mature pine trees bordering the highway and the east side of the railway line. Consequently, vehicles traveling west cannot see a northbound train until it has cleared the tree hedge and is within 82 ft (25 m) of the highway. It was found that mean speeds at the crossbucks for cars and car derivatives were essentially similar on days with trains compared with days without trains. The mean reduction in approach speed of westbound traffic, however, was significantly greater than that for eastbound traffic on all days. This was not the case for commercial vehicles which traveled somewhat more slowly eastbound because of a slight grade in the road. About 1/3 of the drivers looked left and right to see if a train were coming, 1/3 looked only to the right, and the remaining 1/3 did not look at all. This pattern was observed in eastbound and westbound traffic. Westbound drivers who looked left and right had significantly lower speeds at the crossing. Local knowledge of train schedules did not influence crossing behavior significantly. The fact that 1/3 of the drivers did not look at all suggests strongly that advance warning systems at open crossings should differ completely from those at crossings protected by both advance systems and flashing lights. The drivers may have assumed that both systems would be present.

by E. C. Wigglesworth
Publ: Journal of Safety Research v10 n3 p100-7 (Fall 1978) 1978; 5refs
Summary of a longer report sponsored by Ministry of Transport, Vic., Australia.
Availability: See publication

HS-024 338

STATIC PASSIVE OCCUPANT RESTRAINT SYSTEMS WITHOUT AIRBAGS AND WITHOUT BELTS--IS IT POSSIBLE?

Failure to achieve safety belt usage by U.S. motorists has made passive restraint systems desirable alternatives. Air bags are highly effective but costly, particularly in maintenance; and their reliability is not established. The design and development of a static passive restraint system requiring neither air bags nor belts appears feasible. The knees and buttocks can be used as energy input targets by the use of knee bars and advanced-design seat cushions; 65% of the body weight can be restrained using these structures. An extended dashboard for restraint of the upper thigh, a dashboard for impact protection of the chest and shoulders, and a widened, more sloping windshield for head impacts and restraint are within present capabilities. Such a static system promises to be more reliable, particularly as the car ages, and less costly initially. Side impact protection can be improved by the use of fixed laminated side glazing and door structures with improved penetration resistance and interior padding. In order to optimize these proposals, more knowledge of human injury tolerances, kinematics, and injury mechanisms is needed, particularly of the spine and lower extremities.

by John D. States
Publ: Journal of Safety Research v10 n3 p108-14 (Fall 1978) 1978; 25refs
Based on a paper presented at 5th International Congress on Automobile Safety, 12 Jul 1977.
Availability: See publication

HS-024 339

THE EFFICACY OF LICENSING CONTROLS AS A COUNTERMEASURE FOR MULTIPLE DUI [DRIVING UNDER THE INFLUENCE OF ALCOHOL] OFFENDERS

Six-year driving records were compared for 1501 matched pairs of drivers who were convicted of multiple driving-under-the-influence (DUI) offenses in California, in order to assess the efficacy of mandatory license suspensions or revocations in preventing subsequent crashes or DUI convictions among such drivers. This study contrasts with previous studies that explored the effectiveness of discretionary licensing actions in a non-alcohol-related driver improvement setting. Of the present multiple DUI cases, one member of each pair received the mandatory license suspension/revocation while the second pair avoided such licensing control by having prior DUI convictions declared unconstitutional. Both groups of drivers received standard fines and/or jail sentences. Results demonstrate that mandatory licensing actions in addition to fines and/or jail sentences for multiple DUI offenders had a more positive traffic safety effect than fines and/or jail sentences alone. Both the magnitude and duration of the treatment effect associated with mandatory licensing suspension/revocation were documented. The treatment effect associated with the licensing controls was found to exist for 42 months for subsequent DUI occurrence and 48 months for subsequent crash involvement, both periods exceeding the actual term of the suspension or the revocation (12 months and 36 months, respectively). The use of such controls as a precrash countermeasure was most effective for drivers over the age of 30. Countermeasures such as alcoholism/alcohol abuse rehabilitation, discretionary license suspension/revocation, restricted drivers' licenses, or other health approaches might be included in future analyses of the traffic safety effectiveness of alternative precrash measures.

by Roger E. Hagen
057701
Publ: Journal of Safety Research v10 n3 p115-22 (Fall 1978) 1978; 9refs
Funded through a grant from the California Office of Traffic Safety.
Availability: See publication

HS-024 340

SELECTIVE ENFORCEMENT OF DRUNKEN DRIVING IN PHOENIX, ARIZONA

In Phoenix, Ariz., increased enforcement of the laws proscribing driving while intoxicated (DWI) was undertaken in an effort to reduce alcohol-related automobile crashes by increasing the arrest rate, thereby raising the objective probability of arrest; by channeling DWI offenders into alcohol rehabilitation programs so that future drunken driving would not occur; and by intensifying information and education among the general public in order to heighten the subjective probability of arrest. A sizeable increase in drunken driving arrests was one of the major outcomes of the Phoenix Alcohol Safety Action Project (ASAP). Given additional allocation of police resources, it was possible to raise the arrest rate 60% during the ASAP's first year. A total of 11,729 citations were written in 1976, an increase of 75% from the 1971 baseline year. The ASAP motorcycle squad accounted for 20% of all arrests and exerted a catalytic effect on the performance of regular police officers. Analysis of sector rotation data revealed that many more drun-

ken drivers could be apprehended if additional officers were assigned this task. Nevertheless, the subjective probability of arrest remained low, with less than one-third of the driving public believing the risk of apprehension to be high.

by Thomas R. Clay; Paul R. Swenson
DOT-HS-052-1-068
Publ: Journal of Safety Research v10 n3 p130-8 (Fall 1978)
1978; 15refs
Availability: See publication

HS-024 341

CONSTITUTIONAL LAW--DUE PROCESS--SUSPENSION OR REVOCATION OF A DRIVER'S LICENSE WITHOUT PRIOR HEARING DEEMED CONSTITUTIONALLY ADEQUATE

Plaintiff's driver's license was revoked, without preliminary hearing, under an Illinois statute, which provided for such suspension or revocation upon showing that the driver had been repeatedly convicted of traffic offenses, indicating either an inability to exercise ordinary and reasonable care in operating a motor vehicle or disrespect for the traffic laws and safety of other persons upon the highway. Plaintiff made no request for an administrative hearing, as provided for by statute, and instead filed a class action suit challenging the constitutionality of the statute under which his license had been revoked. A three-judge Federal district court granted judgment for the plaintiff, holding that a license could not be suspended or revoked until after a hearing had been held to determine whether the licensee met the statutory criteria for suspension or revocation. On direct appeal, the U.S. Supreme Court reversed and held that the Illinois statute was constitutionally adequate under the due process clause of the 14th amendment (Dixon v. Love, 431 U.S. 105 (1977)). The Court identified a driver's license as a property interest to which the due process clause applies. The Court then went on to weigh the importance of that interest and the governmental interests involved by considering the private interest that would be affected; the risk of an erroneous deprivation of such interest through the procedure used, and the value of other procedural safeguards; and the government's interest, as well as fiscal and administrative burdens that additional procedures would entail. The Court concluded that the private interest in a license to operate a motor vehicle is not so great that an evidentiary hearing is required prior to adverse administrative action, that the risk of an erroneous deprivation in the absence of a prior hearing is not great, and that the public interest in administrative efficiency and particularly in highway safety and the prompt removal of a safety hazard is sufficient to make the state's summary initial decision effective without a pre-decision administrative hearing. The decision of the Supreme Court is challenged. It is advocated that states recognize the serious consequences that flow from a license suspension or revocation and offer meaningful opportunities for licensees to contest prior to a proposed suspension or revocation; for only then will the essentials of procedural due process actually be attained.

by Daniel L. Hovland
Publ: North Dakota Law Review v54 n2 p274-80 (1977)
1977; refs
Availability: See publication

HS-024 342

LOW LIFE CYCLE COST PARATRANSIT VEHICLE DESIGN STUDY. FINAL REPORT

A preliminary design and cost study was performed for a low life cycle paratransit vehicle (PTV), the manufacturing and cost analysis being based on limited production of 5000 units per year for a ten-year period. The Dutcher Industries PTV configuration resembles a small van which will carry six passengers including a passenger confined to a wheelchair. A low floor is standard, and ramps can be provided to make wheelchair entry/exit easier. It is estimated that these PTV's could be manufactured for $10,659.93 each. Operational costs would be lower than for conventional taxi cabs for several reasons. Low vehicle weight and an efficient 4-cylinder engine provide good fuel mileage and low fuel costs. Durable front-end components and excellent component accessibility provide reduced maintenance costs. The six specific tasks of the design study (program plan, prototype design review and parametric study, system and component assessment, repair and maintenance assessment, design data package, and manufacturing cost estimates) are separately discussed. The six-month study was intended to carry the vehicle design only as far as necessary to allow production cost estimates to be made. It is understood that further engineering design effort is required prior to fabrication of pre-production prototype vehicles.

by Philip H. Schneider; David D. Norton
Dutcher Industries, Inc., 7617 Convoy Court, San Diego, Calif. 92111
DOT-TSC-1352
Rept. No. UMTA-MA-06-0052-78-7; DOT-TSC-UMTA-78-14; 1978; 83p refs
Rept. for Apr-Nov 1977.
Availability: NTIS

HS-024 343

MOTORCYCLE NEWS FOR YOU, IF YOU'RE TRADING UP OR BUYING USED

Safety tips are presented for the motorcycle owner who is trading in a smaller bike (dirt or off-road machine) for a larger cycle (touring bike or high-performance bike), as well as advice for a first-time buyer interested in a used motorcycle. For the new owner of a larger motorcycle, the following safe driving tips are offered: train yourself to ride defensively; study your state's rules of the road; maintain space around yourself on the highway; try to maintain the same pace as the rest of the traffic; keep an eye on things up ahead and behind; keep to the left side of the lane (except when in the extreme left lane of a freeway, in which case move to the right side of that lane); wear bright-colored clothing, use reflective tape, and turn lights on; and keep your eye on the road surface. The prospective buyer of a used cycle is advised to learn to ride before buying; think about what you will be doing with the bike before buying (stay away from anything under 200 cc unless the bike is only for commuting); if possible, when shopping take along a friend who knows bikes; get some idea of the bike's condition by looking, listening, and riding; take the bike for a road test (pay attention to transmission (e.g. difficulty in shifting, jumping out of gear), test braking at different speeds); and after road test, put bike on its stand and check wheels, sprockets and chain, and the electrical system,

and try out the accessories. Do not postpone buying an approved helmet since helmets provide real head protection.

Publ: Driver v12 n4 p16-9 (Sep 1978)
1978
Availability: See publication

HS-024 344

WORKSHOP AND RESOURCE MANUAL FOR THE DRINKING DRIVER PROGRAM STAFF TRAINING PROJECT

The primary focus of the two-day Drinking Driver Prog. (DDP) Instructor Training Seminars is to provide all instructors with advanced training and opportunity for discussion on alcohol abuse identification and referral for evaluation. The New York State Alcohol and Drug Rehabilitation Prog., or DDP, has been operational since Fall 1975. Under the terms of its legislation, motorists convicted of driving while intoxicated (DWI) or driving while ability impaired (DWAI), if found to be eligible, may enter an education/rehabilitation program of from seven weeks to eight months. Through active participation in the training workshop, and use of the resource document, it is anticipated that DDP instructors will be able more readily and more appropriately to identify and refer for evaluation those motorists in the classroom who may be in need of treatment for alcohol-related problems. The workshop consists of both cognitive and experiential learning where important informative and research findings in the area of alcohol and highway safety are presented and promising DWI/DWAI alcohol abuse screening and referral tools are discussed. Time is allocated for all participants to share their experiences and to react to the workshop contents. A minimum of 50% of the program is designed to encourage instructor participation in learning activities and techniques that will lend themselves to use in the DDP classroom setting. The resource manual is intended to be informative, readable, and a tool to be used by instructors. The manual's charts, graphs, and other data can be duplicated or made into transparencies. Six major subject areas are addressed: the DDP, the DDP instructor, the nature of alcohol, alcohol abuse and alcoholism, screening for alcohol problems among DWI/DWAI offenders, and alcoholism and alcohol abuse resources.

by Robert P. Lillis; Carolyn Whitbeck; William R. Williford
State of New York, Div. of Alcoholism and Alcohol Abuse, 44 Holland Ave., Albany, N.Y. 12229
1978; 283p 54refs
Prepared in cooperation with State of New York Dept. of Motor Vehicles. Sponsored by State of New York Interdepartmental Traffic Safety Com.
Availability: Corporate author

HS-024 345

METHODOLOGY AND RESULTS OF DURABILITY TESTS OF A COMMERCIAL VEHICLE DRIVE TRAIN

The three interdependent methods of durability testing in the design and development of heavy-duty truck drive trains are theoretical durability analysis, indoor tests carried out on the test stand, and proving-ground tests (road and off-road tests). These three methods complement each other in numerous ways. During the early stage of conception and design, only analytical statements of a mathematical nature can be made. Later, when individual components and assemblies become available, indoor tests can commence. Proving-ground tests are possible only when a prototype is ready or when the components to be tested are ready for installation in another vehicle. Technically, proving-ground tests provide a close simulation to actual practical operation, but show very little flexibility with regard to modifications of components and timelines in the testing process. Indoor testing, however, is faster and more easily varied but still rather theoretical in relation to actual operation. This is even more true in the case of calculations, which presuppose a complete mathematical transformation of the physical reality. However, these calculations, which are well suited for analysis of parametric variations, can be performed quickly, generally requiring little manpower for computer programming. The effects of operating mode, gross vehicle weight, gear ratios, and engine output and torque on service life are considered.

by A. Mischke
Daimler-Benz A.G., Germany
Rept. No. SAE-770675; 1977; 22p 20refs
Presented at International West Coast Meeting, Vancouver, B.C., 8-11 Aug 1977.
Availability: SAE

HS-024 346

A SELF-CONTAINED HEATING SYSTEM FOR COLD WEATHER OPERATION OF FIRE FIGHTING TRUCKS

An integrated, self-contained heating system for use on fire-fighting vehicles to provide full vehicular and fire-fighting operational capability in cold environments to -40 degrees F (-40 degrees C) is incorporated in the A/S32P-4 fire-fighting trucks used by the Air Force for aircraft fire suppression and rescue operations. The vehicle is a 6 x 6 configuration with a gross vehicle weight of 46,600 lb (21,181 kg), 213-in (5.4-m) wheelbase, and a 360-in (9.4-m) overall length. It is a cab-forward design with a single rear-mounted 425 hp (316 kw) 6-cylinder diesel engine which powers both the vehicle and the fire-fighting system. The fire-fighting system consists basically of a 90,000 Btu diesel fuel-burning heater in a piping system which circulates the heated coolant around and through the vehicle engine coolant system, cab heater, the various storage compartments in the vehicle body structure, and back through the engine oil pan to the booster heater. Finned-tube heat exchangers in the various compartments radiate heat from the heated coolant supply to maintain compartment temperature above the freezing point of water. A recirculating pump is provided to maintain a constant flow of heated coolant to all parts of the system. A second system within the vehicle consists of a pump and piping to recirculate agent system water through a heat exchanger where it draws heat from the primary system, through the discharge piping, the water tank, water pump, recirculating pump, and back to the heat exchanger. Operation of the winterization system is intended primarily for standby operations and requires that either the main engine be running, or the auxiliary power supply be connected to a remote source to avoid excessive drain on the vehicle's batteries. Complete insulation of agent, piping, and control valves is necessary to minimize the loss of latent heat and heat generated by the winterization system. The P-4 also includes features for cold-weather vehicle operation common to other type trucks

(engine cold-start aid, radiator shutters, use of cold weather-rated elastomers, and arctic-grade fluids).

by James A. Westphal
Oshkosh Truck Corp.
Rept. No. SAE-770676; 1977; 10p
Presented at International West Coast Meeting, Vancouver, B.C., 8-11 Aug 1977.
Availability: SAE

HS-024 347

CONSIDERATIONS IN BUILDING AN ARCTIC PIPELINE WELDING SHELTER

The design and development of a pipeline welding shelter system, tentatively named the Pioneer Weld-Plex, for use in Arctic weather conditions are outlined. To provide a shelter that could be moved in the worst weather conditions, the complex was mounted on a four-track vehicle with center frame steering and having a ground pressure in the area of 4 psi. The welding shelter itself had to be large enough to provide shelter and facilities for six men and to handle welding equipment weighing up to one ton; a size of 10 ft wide by 14 ft long was selected. For stability during moves and high winds, a special double-arm crane was designed, with the controls in both the vehicle cabin and shelter. For starting welding equipment in cold weather an insulated powerhouse was built on the rear of the vehicle. This powerhouse contains a 150-kw diesel generator with a 30,000-Btu oil-fired heater for start-up, as well as gas bottles necessary for automatic welding, the rectifiers or motor generator sets, and the controls for automatic welding, if this system is used. To the rear of the powerhouse is an insulated room, large enough for four men, suitable for a lunchroom or for survival in case of bad storms. Toilet facilities are provided. In order to work in total darkness, floodlights were mounted on the roofs of both the powerhouse and the vehicle cab. The 150-kw generator supplies power for the welding units, the electrical heating of the welding shelter, as well as the floodlights. Drive power is taken from the front of the diesel generator set by means of an hydraulic pump and motor, the pump being of the variable-displacement type and controlled by the foot throttle in the cab. The hydraulic motor in turn drives into a standard torque converter and four-speed power-shift transmission. The welding shelter itself is equipped with electrostatic smoke eliminators and electric heat, making the environment more like a shop operation than a field operation.

by W. Bruce Nodwell
Canadian Foremost Ltd.
Rept. No. SAE-770677; 1977; 4p
Presented at International West Coast Meeting, Vancouver, B.C., 8-11 Aug 1977.
Availability: SAE

HS-024 348

MASS TRANSPORTATION ALTERNATIVES: AIR, HIGHWAY, BUS AND RAIL

The past, present, and future of passenger traffic in the U.S. via interstate highway, rail, air, and bus systems are examined in terms of transportation needs in both urban and rural areas, and of problems which must be solved before mass transportation is a viable alternative to the private automobile. Air passenger traffic has grown at a rate of almost 12% a year since 1945, and revenue load capacity of the U.S. air carriers more than doubled between 1961 and 1971. Government support has been in the form of mail subsidies, air traffic control systems and navigational aids. The interstate highway system is now scheduled for completion by Sep 1990; a factor in the program slippage and cost escalation has been the inflation of construction costs, more rapid than for the general economy. Traditionally interstate highway construction has been pay-as-you-go. Serious consideration should be given to proposals to permit borrowing to complete the system faster. The most widespread service of any of the common carrier passenger modes is the interstate and intercity bus industry. These private companies receive neither direct subsidies nor tax exemptions, although they do ride on tax-built roads. For the most part these buses are profitable, being able to diversify to include charter, special service and package express, a growing field. In 1974, 27% of operating revenues stemmed from these non-regular route services. Rail passenger travel has been reduced to less than 1% of the national total, because of the automobile, bus and plane. The most promising route for increased passenger use is Amtrak's high-speed northeast corridor, from Boston to Washington, D.C., designed for a run of a little over six hours, with 10 stops. Transportation problems in nonmetropolitan small urban and rural areas differ from problems in metropolitan areas. Local transportation here takes place almost entirely by car, almost all of it for personal auto travel. The lack of alternatives to the private auto is perhaps the major transportation problem in these areas. Lack of transportation in rural areas causes limited social communication, high unemployment, inadequate use of public services, low educational levels and lack of variety in consumer goods. Tunneling for subways must be made less costly. Light-rail may be a solution to tearing up the streets and disrupting traffic, but it too is expensive. Attention must be focussed on inner modal transfer (from cars to buses to rail to people movers). Systems that will operate with a minimum of manpower are needed. To measure system performance and determine the improvements needed to satisfy users and decision-makers, dollar estimates must be made of all the costs to society resulting from each type of transportation (actual user costs, costs in terms of time spent transporting people, external costs of transportation (e.g. hazards, air pollution, noise, dependence on foreign resources), and the taxpayers' costs for items such as subsidies).

by Philip A. Smith
General Electric Co.
Rept. No. SAE-770679; 1977; 8p
Presented at International West Coast Meeting, Vancouver, B.C., 8-11 Aug 1977.
Availability: SAE

HS-024 349

THE U.S. STANDARD LIGHT RAIL VEHICLE--A PROGRESS REPORT

The U.S. Standard Light Rail Vehicle (SLRV) was designed by Boeing Vertol Co., to a specification developed under the sponsorship of the Urban Mass Transportation Administration (UMTA), as a replacement vehicle for aging Presidents' Conference Com. (PCC) streetcars in several U.S. cities, and as an efficient vehicle for new light rail transit systems. A brief overview of the technical and design features of the SLRV is presented, as well as an in-depth discussion of the test program and the SLRV introduction into revenue service in Boston. The SLRV is an articulated, six-axle, bidirectional

vehicle. The truck at each end of the vehicle incorporates a monomotor which delivers power to the axles through the right-angle gearboxes. The center truck is unpowered and supports the articulation section. The articulation unit allows the vehicle to turn in a horizontal radius of 42 ft for operation on city streets. The test program consisted of three major phases: design support tests, component qualification tests, and vehicle performance and running tests. Significant problems encountered during development were resolved; these were related to door opening and closing mechanisms, the propulsion control system, dust/dirt ingestion, and the side bearer plate supporting the car body. The SLRV was first put into revenue service in Boston on 30 Dec 1976. Boeing is scheduled to continue SLRV deliveries to Boston at a rate of approximately 10 per month, with delivery of the 175th car in May 1978. Two test SLRV's are scheduled to go to San Francisco in August 1977; production deliveries to that city are scheduled to begin in Apr 1978 and continue at the 10 per month rate with the 100th car delivered in Apr 1979.

by John M. Cord; Peter R. Norton
Boeing Vertol Co.
Rept. No. SAE-770680; 1977; 12p 3refs
Presented at International West Coast Meeting, Vancouver, B.C., 8-11 Aug 1977.
Availability: SAE

HS-024 350

THE REGENERATIVE CHOPPER PROPULSION SYSTEM FOR MODERN TRANSIT

The regenerative chopper DC propulsion system for transit cars offers a substantial economic saving over more conventional types of DC traction systems. The system utilizes a separately excited DC traction motor controlled in various modes by power control units utilizing thyristor elements and capable of full regeneration. The system is readily adaptable to the range of third rail DC voltages normally encountered on today's transit properties. In addition, during braking, the system will attempt to regenerate all the braking energy of the car to the third rail. If the rail is unable to accept the total energy, as much as possible is delivered to the rail, and the balance is absorbed by dynamic brake resistors or friction brakes. A description is presented for one of the various regenerative systems currently used. A simplified analysis shows that the economic advantages of the system are readily achievable by the transit operator. The contribution of the separately excited DC traction motor to this economic gain is identified. Within a framework of reasonable limits, the regenerative chopper system can show a cash out-of-pocket saving in excess of $250,000 per car over alternative DC traction systems (over the 30 year car life).

by John G. Kimball
Airesearch Mfg. Co.
Rept. No. SAE-770681; 1977; 12p
Presented at International West Coast Meeting, Vancouver, B.C., 8-11 Aug 1977.
Availability: SAE

HS-024 351

MASS TRANSIT DRIVE TRAINS

Various drivetrain projects in which Rockwell International has been involved over the past five years are reviewed in an attempt to show the progression that can and has been made in the evolution of drivetrain systems for the mass transit industry. One of Rockwell's major objectives is to advance the state of the art by designing for lighter-weight, low-cost, easy-to-maintain, efficient drivetrain systems. Rockwell has contracts for the design, development, and production of a number of drivetrain systems including the Light Rail Vehicle (LRV), which is presently being phased into operation in Boston and San Francisco; the Chicago Transit Authority Vehicle, also in the early introductory stage; the MARTA vehicle, being developed for the Atlanta Transit Authority; and the Advanced Concept Train (ACT I), designed and developed for the Dept. of Transportation. The CTA, LRV and ACT I vehicles are reviewed in detail, since they best illustrate the progression from conventional design practices to an advanced state-of-the-art by technological transfer. Mass transit drivetrain systems can be significantly improved by applying advanced technological knowledge developed in other industries. Design philosophies developed and proven in the heavy-duty truck industry are applicable.

by Anthony Rieli
Rockwell International
Rept. No. SAE-770682; 1977; 16p
Presented at International West Coast Meeting, Vancouver, B.C., 8-11 Aug 1977.
Availability: SAE

HS-024 352

THE DESIGN OF SPECIAL TYPES OPERATION TRUCKS

Special problems posed in the design and operation of truck for carrying large indivisible loads, with particular reference t the U.K., are discussed. The relevant legislation, market, an vehicle operation are reviewed. Legislation is not compreher sive; all vehicles over 32 tons GTW (gross train weight) or o abnormal dimensions come into the Authorisation of Specia Types category which is split into two parts (up to 150 ton GTW and over that weight). The legislation dictates the basi principles of operation (speed at which a truck travels, max imum ground loads on each axle, and permitted vehicle con figuration). However, the effective control is in the sanctio that must be granted by the Ministry of Transport for eac movement on public highways. Most major cities in the U.K will not allow heavy or oversized loads to be transported dur ing daytime hours; routes are carefully selected. The ad vantage of a tractor-semitrailer combination over a ballasted tractor-full trailer outfit is that the additional burden of ballas does not have to be carried. This is important when bridges have to be crossed. Articulated vehicles also have superio maneuverability. The principal disadvantage of articulated vehicles is the load transfer effect of a high hitch point at the fifth wheel. The resulting weight transfer under traction reduces the front axle load, and hence, steerability. Currently, the breakeven point for articulated vs. ballasted vehicles is at 60-70 tons payload; payloads of up to 100 tons may become more common on articulated vehicles, provided that the expense of a tractor or trailer that departs from current commercial vehicle practice can be justified. The concept of a "special types" truck (vehicles in the payload range from 50 tons) is briefly discussed, along with a summary of recommendations of the U.K. Society of Motor Manufacturers and Traders Ltd. which has been preparing a proposed Code of Practice that relates GTW's, operating speeds, and retardation performance. These proposals are based on an assessment of the practical limitations of current technology and represent British prac-

tice. Design criteria of units and systems unique to this "special types" operation are considered in-depth, with separate discussions of power unit requirements, transmission requirements (rear axle types, axle beam rating, clutches, transmissions, auxiliary transmission, torque for axle rating, axle transmission rating), wheel and tire equipment, cab features, frame design criteria (static laden loads, power unit and transmission loads, steering loads, coupling loads, winching loads, slinging, frame construction, frame packaging), foundation brake design criteria, and multi-tug operation.

by Christopher David Cernes
British Leyland UK Ltd.
Rept. No. SAE-770683; 1977; 14p
Presented at International West Coast Meeting, Vancouver, B.C., 8-11 Aug 1977.
Availability: SAE

HS-024 353

RATIONAL USE OF ENERGY IN ROAD TRANSPORT

The most important factor in truck transport for using fuel rationally is the truck combination size and choice of power train. A method for calculating both transport time and fuel consumption for various restrictions in maximum speed was developed. How this method can be applied for optimizing the power train for economy is shown. The diesel engine with direct injection is so far without competition in commercial operation in using fuel efficiently. Further improvements in this engine are likely. Development of Scania engines from 1944 to the present is described to illustrate how specific fuel consumption has been improved. Important contributions to improved fuel economy can be made by good maintenance, radial tires, devices for reducing air resistance, and good driving techniques. The most important factor for lowering the specific fuel consumption per transported ton and km payload is the use of as high train weight as possible for the road conditions. When properly utilized, a high power-to-weight ratio can be beneficial from a fuel economy point of view, and is essential for road safety as well. For given road conditions and total train weight, an engine should be selected with sufficient power to maintain the average speed. A powerful engine will require less gear shifting and produce less noise, both factors easing the strain on the driver and thereby adding to safety.

by Sverker Sjostrom
Saab-Scania, Scania Div., Sweden
Rept. No. SAE-770684; 1977; 10p 1ref
Presented at International West Coast Meeting, Vancouver, B.C., 8-11 Aug 1977.
Availability: SAE

HS-024 354

AXLE LOCATING AND SUSPENSION SYSTEMS FOR COMMERCIAL VEHICLES

Alternatives for the conventional leaf springs in commercial vehicle suspension systems are presented. The position of the roll center is diagrammed for four different axle suspension systems (rigid axle with leaf springs, dual-joint swing axle with helical springs, double wishbone suspension and coil springs, and axle with trailing arms), and the side tilt angle for variations of these different systems is calculated. The characteristics of systems which simultaneously fulfill suspension and axle-locating requirements (especially leaf springs on commercial vehicles) vs. those systems which serve exclusively to absorb vertical forces (mechanical springs such as coil or torsion-bar springs or pneumatic and hydraulic systems) are discussed. Detailed examples are presented for commercial vehicle suspension systems other than the conventional leaf spring design. These designs for buses, trucks, and cross-country (off-road) vehicles excel in ride characteristics and offer the advantage of less weight, compared with conventional versions. Lighter weight commercial vehicles will save energy.

by Hans Hagen
M.A.N.
Rept. No. SAE-770685; 1977; 18p
Presented at International West Coast Meeting, Vancouver, B.C., 8-11 Aug 1977.
Availability: SAE

HS-024 355

VEHICLE DESIGN FOR THE MOVEMENT OF ABNORMAL LOADS

Vehicle specifications for tractor-trailer combinations (using as many as four haulers) for transporting abnormally heavy loads (200-ton and 400-ton loads, respectively) in South Africa, according to the requirements of the South African Railways, are itemized, with substantiating calculations. A method for the calculation of the effect of abnormal loads on bridges is presented. Regulations affecting weight and load distributions have influenced the design of specialized trailers and vehicles for abnormal-load hauling, and restriction on the loading of the hauling vehicle's drive axles limits tractive effort and the ability to move the load, necessitating the use of multiple hauling tractors. The regulations and requirements for these particular vehicles are not unlike those for European countries, only more restrictive because of road-bed foundation materials and bridges which were not designed to carry such heavy loads. Heavier mass loads are being transported in Europe with fewer vehicles because the haul vehicles can be ballasted to a greater degree, thus increasing traction. In Europe, much of the hauling would be for short distances over selected routes, whereas in South Africa many of the abnormal hauls could be for more than 248 km (400 mi) inland with no alternate routes to avoid structures without the capacity for the intended load. For each abnormal load, a separate permit is issued through the province administration. Before any abnormal load vehicle is purchased, imported or constructed, permission should be obtained to ensure that it will be granted authority to operate on public roads.

by George K. Boulet
Pacific Truck and Trailer Ltd.
Rept. No. SAE-770686; 1977; 24p 1ref
Presented at International West Coast Meeting, Vancouver, B.C., 8-11 Aug 1977.
Availability: SAE

HS-024 356

DESIGNING "THE UNIVERSITY OF BRITISH COLUMBIA ELECTRIC CAR" WITH FOAM-FIBERGLASS STRUCTURE AND AN AC DRIVE

Problems, possible solutions, and future prospects in designing and building a four-passenger, high-performance electric vehicle are described for an electric car designed by Univ. of British Columbia engineering students, assisted by the Electri-

cal Engineering and Mechanical Engineering departments. Experience gained from an earlier design called The Wally-Wagon, which won the 1972 Urban Vehicle Design Competition in Detroit, was used. The space-efficient, four-seat, all polyurethhane foam-fiberglass, high-performance city-highway electric car is powered by a microprocessor-controlled AC drive via modified automatic transmission. It was designed for expected higher energy density batteries but is being tested with available lead-acid batteries. The prototype was built to test the validity of numerous unconventional approaches, such as AC drive with the inverter and the microprocessor, the modified automatic transmission, the foam-fiberglass chassis and body, the side door lifting mechanisms, and the practicality and attractiveness of the general layout. Final tests should involve straight line performance, acceleration, top speed and hill climbing; braking distances; cornering power and behavior; deflection of the chassis and body to determine the degree of overdesigning involved and estimate the optimal weight; wind tunnel tests to determine drag and airflow; and a public opinion survey to determine reactions. After tests and modifications on this prototype, resulting modified designs are to be proposed according to the scale desired, and to materials commercially available. With the increasing fuel shortage and the development of better batteries, such an electric car seems the most likely successor to its internal combustion engine-powered counterpart.

by Dobzosav Ratajac
University of British Columbia, Dept. of Mechanical Engineering, B.C., Canada
Rept. No. SAE-770688; 1977; 12p 5refs
Presented at International West Coast Meeting, Vancouver, B.C., 8-11 Aug 1977.
Availability: SAE

HS-024 357

TECHNICAL FEATURES OF THE VIKING 4 RESEARCH VEHICLE

A research vehicle was designed and constructed by students at Western Washington State Coll., the design criteria including produceability using existing technology and facilities, excellent economy, low emissions, compliance with existing safety standards, and superior performance. One of the primary means of attaining these goals was through aerodynamics; aerodynamic features utilized in the Viking 2 experimental car were further refined and incorporated in this Viking 4 prototype vehicle. The configuration chosen was rear wheel drive with mid-engine location, desirable for handling, traction and control on loose surfaces. Two-passenger capacity was considered desirable for economy; access to the vehicle is by a forward-opening hatch. Suspension is of the long and short arm link type both front and rear with coil springs over shock-absorbing units. The transmission chosen was a 1970 Volkswagen four-speed transaxle, because of its lightweight cast magnesium housing. The cooling system consists of an aluminum water radiator and copper oil radiator. Air conditioning would increase marketability. Extensive use of aluminum in a monocoque chassis and nonstressed body allows low weight. Five-miles-per-hour bumpers of elastometric urethane are fitted, and aluminum honeycomb is used as impact-absorbing deformable structures. Several rotary engines are planned for development in this vehicle. Aerodynamic testing at high speed is planned for Oct 1977 at the Bonneville Salt Flats.

by Paul Tiffany
Western Washington State Coll., Vehicle Res. Inst.
Rept. No. SAE-770689; 1977; 8p
Presented at International West Coast Meeting, Vancouver, B.C., 8-11 Aug 1977.
Availability: SAE

HS-024 358

OPERATIONAL ROAD TESTS OF TRUCK AERODYNAMIC DRAG REDUCTION DEVICES

A study has been conducted to evaluate the fuel economy per formance of retrofit aerodynamic-drag-reduction devices fo straight trucks and semitrailers. The three devices tested wer an airshield wind deflector, a nose cone, and an airshield ga seal; a wind deflector plus gap seal combination was also co sidered. Carefully controlled road tests were conducted alo with a survey of Canadian fleet experience. Data from t road tests were compared with fuel savings based on sca model drag coefficients measured in a wind tunnel. Results dicate that, although the performance of a drag-reduci device is affected significantly by ambient winds, truckers c expect fuel savings in the order of 1 3/4 gal/100 mi for strai trucks and 1 1/4 gal/100 mi for semitrailers (imperial gallo at a cruising speed of 55 mph. The best add-on device for tr tor-trailers, of those tested, is the wind deflector and gap s combination. Because of the current methods of keep records by Canadian trucking firms, fleet data were inadequ for this study; the records kept were not in sufficient detai permit the computation of incremental fuel savings (of 5% 10%) resulting from use of add-on aerodynamic devices.

by W. R. Davis; N. D. Eryou; J. C. Patry
Davis, Eryou and Associates Ltd., Canada
Rept. No. SAE-770690; 1977; 14p 10refs
Presented at International West Coast Meeting, Vancouver, B.C., 8-11 Aug 1977. Sponsored by Transport Canada, Strategic Studies Branch.
Availability: SAE

HS-024 359

SIMULATION OF MOTOR-SCRAPER OVERTURNS

A mathematical model for simulating three-dimensional ov turns of motor scrapers is described, and the output from t simulation program for one typical overturn case is illustrat and discussed. Detailed information from the simulation su as the total kinetic energy, tire forces, position and velociti of the scraper body, etc., provide the data necessary f ROPS (Roll-Over Protective Structures) tests. The simulati results seem to reasonably represent the motion of a vehic overturning on an embankment and could serve as a means studying scraper and other articulated-vehicle motions on th and other terrain. The model is also general enough to perm the study of many different types of braking and steering a tions and, therefore, may serve as a means for qualitative st dies of vehicle motion.

by S. Okuno; G. E. Rehkugler
Komatsu, Ltd.; Cornell Univ., Ithaca, N.Y.
Rept. No. SAE-770703; 1977; 15p 10refs
Presented at Off-Highway Vehicle Meeting and Exhibition, Milwaukee, 12-15 Sep 1977.
Availability: SAE

HS-024 360

ALLIS-CHALMERS APPLIES MODULAR ELECTRONICS IN COMBINES

Price, option requirements, marketing requirements, reliability, and serviceability were all taken into account in Allis-Chalmers' decision to utilize a modular approach for electronic components, vs. a completely integrated singular system, for its agricultural combine monitoring systems. The individual modules had to be durable, similar in appearance, easily serviceable, reliable and easily installed on a factory assembly line. The modular approach has proved to be a cost effective way to offer combine owners a variety of electronic monitoring devices (basic warning system, shaft speed monitor, auxiliary warning system, tachometer, grain loss monitor). It also provides for the possibility of further additions to monitor or control new combine applications. To aid in diagnosis and repair of electrical problems, a module tester is available which can thoroughly check any electronic module currently available on the combine. By addition of an adapter, the monitor system used on agricultural tractors can be checked as well. Tests for several proposed systems are included in the tester and can be implemented by issuing new instructions.

by K. Almquist
Allis-Chalmers Corp.
Rept. No. SAE-770701; 1977; 8p
Presented at Off-Highway Vehicle Meeting and Exhibition, Milwaukee, 12-15 Sep 1977.
Availability: SAE

HS-024 361

COMPUTER SIMULATION OF TRACTOR RIDE FOR DESIGN EVALUATION

An analytical method is described for evaluating the effect of design changes on tractor ride characteristics. The method uses a digital computer program implementing a three-dimensional nonlinear mathematical model for simulating tractor rigid body vibration resulting from travel over a specified test track. The mathematical model allows the prediction of the time history of the fore-aft, lateral, and vertical acceleration of any point on a tractor chassis, front axle assembly, cab, or seat. Spectral and modal analyses are used to interpret the simulation results and provide a qualitative evaluation of the effects on ride of a given design change. The natural frequencies and corresponding mode shapes of the modes of vibration of the tractor-cab system provide considerable insight into the resonances indicated by the spectral analyses.

by David W. Smith
Deere and Co.
Rept. No. SAE-770704; 1977; 15p 8refs
Presented at Off-Highway Vehicle Meeting and Exhibition, Milwaukee, 12-15 Sep 1977.
Availability: SAE

HS-024 362

TRACTOR RIDE COMFORT PACKAGE

Although a tractor operator is subjected to acceleration in all three orthogonal directions, traditionally, tractor suspensions have isolated vibration only in the vertical direction. Measurements reveal that isolation of longitudinal acceleration provides the best complement to the vertical suspension on two-wheel-drive (2WD) tractors. John Deere has developed a ride comfort package which provides the first bidirectional suspension offered on a 2WD tractor. Objective measurements of the performance of the combination of the semi-active suspension and horizontal attenuator of this system indicate a 25% to 30% improvement in ride. Subjective evaluation in the field showed a 1.6 kph (1.0 mph) increase in field operating speeds with equivalent ride comfort. Seats used provided individually adjustable height armrests, cushions covered with durable cloth, and seat belts that were individually adjustable with retractors. The contour of the seat cushion, shape of the backrest, and location of the adjustable lumbar support were developed by a combination of subjective evaluation and medical input.

by James E. Thompson
John Deere Product Engineering Center
Rept. No. SAE-770705; 1977; 8p 4refs
Presented at Off-Highway Vehicle Meeting and Exhibition, Milwaukee, 12-15 Sep 1977.
Availability: SAE

HS-024 363

STEIGER TRACTOR'S TIGER III, ST-450

The design, development, and testing of a new 450 hp four-wheel drive articulated farm tractor are summarized along with an overview of the vehicle systems. It will meet the demand for new higher horsepower four-wheel drive tractors. The Tiger III, ST-450 uses the Cummins KTA-1150-C470 engine. It is an inline six-cylinder, four-cycle turbocharged and aftercooled direct-injected diesel. The 470 hp at 2100 rpm, 450 hp at 1500 rpm is not a standard Cummins horsepower rating, but a special high torque rise version. It will provide the ground speeds needed for a farm tractor and provide proven powershift transmission needed to fill the gap between the gear splits. Several frame designs different from production tractors were used along with more convenience and comfort ideas in the new wider ROPS (rollover protection structure) cab. The wide frame provides plenty of room around the engine and transmission and the swing-out grill and tilt-up hood will please the service-minded.

by David Majkrzak
Steiger Tractor Inc.
Rept. No. SAE-770707; 1977; 12p 4refs
Presented at Off-Highway Vehicle Meeting and Exhibition, Milwaukee, 12-15 Sep 1977.
Availability: SAE

HS-024 364

J I CASE MODEL 2870 FOUR-WHEEL DRIVE TRACTOR

A description is provided of the J I Case Co. 300 engine hp four-wheel drive Model 2870 Traction King tractor, introduced in Oct 1976. The Model 2870 was designed as a completely new tractor to meet the following customer demands: new engine for higher horsepower (a 674-cubic-inch, direct injection, turbocharged in-line six-cylinder, four-cycle diesel which produces 252 PTO horsepower at 2200 rpm), new transmission and axles which give on-the-go shifting and steerable axles, new styling which is functional as well as pleasing to the eye, and improved cab environment for operator comfort and convenience. All the new components and features give the

customer the increased reliability, serviceability, and operator comfort that today's professional farmer demands.

by Darrel J. Svendsen
J I Case Co.
Rept. No. SAE-770708; 1977; 11p
Presented at Off-Highway Vehicle Meeting and Exhibition, Milwaukee, 12-15 Sep 1977.
Availability: SAE

HS-024 368

REMOVAL OF EXHAUST PARTICULATE FROM A MERCEDES 300D DIESEL CAR

A total of 377 runs with some 48 devices or combinations were made to identify a candidate system for diesel exhaust particulate collection. The Texaco alumina-coated steel wool packed units, similar to the mufflers on the 1975 Mercedes 300D, were selected as the best available for "agglomeration". The Ethyl inertia separator was added to promote collection of the particulate. This system, when new, reduced particulate by two-thirds. An extensive series of tests was made to determine what effect the trap system might have on other exhaust emissions. The major effects are as follows, based on replicate transient and/or steady-state testing with the trap system relative to the stock factory exhaust system at comparable conditions: hydrocarbon (HC), about 40% less; carbon monoxide (CO) and nitrogen oxides, no change; economy, negligible to slight decrease; higher exit noise, directional; engine exhaust backpressures, substantially higher, about 11 times the standard exhaust backpressure of 25 mm Hg at 80.5 kph; odor, noticeably less intensity and different quality; diesel odorant analytical system, lower and consistent to odor panel ratings; smoke, lower overall with occasional higher peak opacities during acceleration; sulfate, 10% of factory system; BaP (benzo-alpha-pyrene), about half factory system; and acceleration times, up to 20% longer under maximum acceleration conditions. The noticeable and sometimes substantial effect on HC, odor, smoke, sulfate, and BaP were encouraging and not necessarily expected. The major drawback is the substantial exhaust backpressure and the effect of this on vehicle acceleration. Throughout the laboratory testing, the effectiveness of the trap system decreased. Eventually, the alumina-coated wire packs would reach equilibrium, cease acting as traps, and operate solely as agglomerators. This occurred at about 4827 km with the system (2853 km in lab and 1974 km on Motor Vehicle Manufacturers Assoc. (MVMA) road course). An additional 10,094 km of MVMA operation was performed to define the long-term potential. Although particulate was collected by the inertia separator, the system efficiency was negligible (on the order of 6%), indicating that the particulate exiting the units packed with alumina-coated wire, under equilibrium conditions, to be no better than inertial separation from the factory-equipped car. Agglomeration of particulate into heavier, not just bigger, sizes appears to be the key to diesel exhaust particulate removal. Once done, the carbon may act as a carrier in removal of other undesired emissions such as HC, BaP, sulfate, and odorous compounds.

by Karl J. Springer; Ralph C. Stahman
Southwest Res. Inst.; Environmental Protection Agency
EPA-68-03-2116
Rept. No. SAE-770716; 1977; 27p 19refs
Presented at Off-Highway Vehicle Meeting and Exhibition, Milwaukee, 12-15 Sep 1977.
Availability: SAE

HS-024 369

MOVE TO SMALLER, LIGHTER CARS CONTINUES

U.S. automakers are using lighter metals, more plastics, and new technology to achieve Federal mileage and exhaust emissions standards. Downsizing is still the dominant theme, as automakers strive to meet ever more stringent fuel economy regulations. For 1978, the corporate average fuel economy standard is 18.0 mpg; for 1979 models, it is 19.0 mpg; a 27.5 mpg average will be required for 1985. If the 1985 figure is to be met, the average car can weigh no more than about 3000 lb or about 1000 lb lighter than the current average. If that weigh reduction were to be achieved by downsizing alone, th average 1985 car would be no bigger than today's subcon pacts. To avoid this, automotive engineers are turning mo and more to lighter replacements for cold-rolled steel and ca iron. Plastics are among the leading contenders. Substituting lb of plastic for a heavier metal results in about 1 lb reducti in vehicle weight. Although there are dozens of plastic parts each 1979 car, probably the most notable new technology the use of reaction injection molding (RIM) to make la polyurethane body parts. Aluminum often can provide grea weight savings than plastics (reduction in vehicle weight about 1.3 lb for every pound of aluminum used to replace n steel or cast iron). Aluminum already is used extensively in gine components and for bumpers and bumper reinforceme Despite the inroads being made by plastics and alumin much of the steel in today's cars will be replaced in ton row's lighter models by "high-strength" steels, which h yield strengths one and a half to three times that of conv tional low-carbon steels. High-strength steels currently used in side-impact beams, bumper support bars, and b panels. Use of thinner glass also provides opportunities shed a few pounds. Drivetrains are changing; big engines 400-cubic-inch displacement and above are fast disappear from the passenger car scene. More diesel engines are be produced for fuel economy and emission reasons, as are t bochargers (compressors driven by exhaust gases which crease engine efficiency by force-feeding fuel/air mixture i the cylinders). Exhaust emission standards for passenger c are the same in current models as for 1978 models. Howev there are more three-way catalysts this year, particularly cars destined for California, where emission standards a stricter than for the rest of the U.S. Hardly any approach overlooked in the campaign to improve fuel economy. A ratios are lower; overdrive transmissions are reappearin lockup torque converters are being extended (these elimina the energy loss caused by slippage of the fluid coupling of automatic transmission at highway speeds); attention is bei given to the aerodynamics of car bodies, and tire pressures a going up, to reduce losses from rolling friction.

by Ward Worthy
Publ: Chemical and Engineering News v56 n42 p25-6, 28 (16 Oct 1978)
1978
Availability: See publication

HS-024 370

MOTOR VEHICLE INSPECTION

Vehicle inspection in all its phases as recommended by the Motor Vehicle Manufacturers Assoc. and the American Assoc. of Motor Vehicle Administrators, is discussed for those involved in periodic motor vehicle inspection (PMVI). In Part 1, the operation of and procedures for inspecting passenger cars

and light trucks are described in the following chapters: motor vehicle inspection and accidents; introduction to vehicle inspection; introduction to the automotive vehicle; inspecting vehicle license, registration, and insurance; tire and wheel inspection; vehicle suspension systems; vehicle suspension-system inspection; automotive vehicle steering systems; vehicle steering-system inspection; front-end alignment inspection; automotive vehicle brakes; vehicle brake inspection; vehicle lighting and electric-system inspection; inspecting vehicle glazing; inspecting the vehicle body and accessories; inspecting the fuel system; inspecting the exhaust system; automotive vehicle emission controls; and automotive emission-control inspection. In Part 2, inspection procedures for heavy-duty motor vehicles (trucks, truck-tractors, trailers, and commercial buses) are discussed in the following chapters: special problems in inspection of heavy-duty vehicles; inspecting truck and bus tires and wheels; truck and bus steering, alignment and suspension inspection; heavy motor vehicle brakes; heavy motor vehicle brake inspection; heavy motor vehicle lighting and electric-system inspection; and inspecting heavy-duty vehicle body and engine systems. Part 3 is concerned with inspection procedures for school buses, with emphasis on the special checks to be made. Each chapter contains illustrations, review questions, and recommendations of projects for the motor vehicle inspector to do in order to help understand more about motor vehicle inspection. Appendices contain Chapters 12 and 13 of the Uniform Vehicle Code, ball-joint inspection limits, wheel-alignment inspection limits, passenger-car headlight aiming procedures, identifying code for automotive lights and signaling devices (SAE Lamp Code), truck ball-joint inspection limits, truck wheel-alignment inspection limits, truck headlight aiming procedures, and school bus wheel-alignment inspection limits. A subject index is provided.

by William H. Crouse; Donald L. Anglin
1978; 369p
Availability: McGraw-Hill Book Co., Gregg Div., New York

HS-024 371

RAILROAD-HIGHWAY GRADE CROSSING HANDBOOK

A summary of past accomplishments and existing techniques, and a compendium of applicable concepts, technology, and practice, in railroad-highway grade crossing improvements in the U.S. are presented. A better understanding of available methodology should lead to widespread acceptance and implementation with available funds, and an emphasis on securing additional improvement funds. This handbook is aimed primarily at providing railroad, state, and municipal personnel with information which can aid them in their cooperative efforts to improve conditions at grade crossings (to reduce the accident frequency and severity at grade crossings, and to improve operating efficiency). Techniques and equipment developed over the years have produced commercially-available hardware, and research and development efforts are continuing to advance technology. This handbook, however, does not attempt to report in depth on those research efforts, but rather to discuss basic concepts, the use of which have proven satisfactory. Major objectives of the handbook are to describe conditions and requirements at crossings, facilitate understanding of elements of crossing systems, provide a compendium of existing grade-crossing technology, serve as a guideline to aid in implementing improvements to railroad-highway grade crossings, aid understanding and application of new technology, and serve as a basic text for training programs. Chapter titles are: introduction; grade crossing components and relationships; program administration; program development; site improvements; crossing surfaces; grade crossing traffic control devices; and grade crossing research and development. This handbook has been designed as an information source for railroad-highway grade crossing improvement; it does not establish standards and does not imply or suggest inadequacy of any existing installation.

by Robert M. Olson; William R. Stockton; William C. Rogers; Hoy A. Richards; Charles Pinnell; Thomas M. Newton
Texas A and M Univ., Texas Transportation Inst., College Station, Tex.
Rept. No. FHWA-TS-78-214; 1978; 258p refs
Sponsored by Federal Hwy. Administration. Technology Sharing Rept.
Availability: GPO, stock no. 050-005-00027-5

HS-024 372

LIGHT-DUTY DIESEL EMISSION CORRECTION FACTORS FOR AMBIENT CONDITIONS

To determine the effects of ambient conditions on emissions from light-duty diesels, 174 emission tests were conducted on four vehicles (Datsun 220C, International pickup with Perkins 6.247 engine, Mercedes 240D, and Peugeot 504D). The major objective was estimation of a factor to correct NOx (nitrogen oxides) emissions to a standard humidity. Other emissions and ambient conditions were also examined for relationships by regression analysis. Increases in humidity were associated with substantial decreases in NOx for all four vehicles. Changes in temperature were associated with relatively minor changes in NOx for all vehicles. Changes in humidity and temperature were associated with relatively minor changes in production of hydrocarbons (HC) and carbon monoxide (CO) from three of the four test vehicles. HC and CO from the International pickup were more strongly dependent on humidity and temperature than the other three vehicles, possibly the result of the much lower specific loading of the Perkins engine as compared to the others. Several types of NOx-humidity correction factors were estimated and compared to those already used for other vehicle and engine classes. Combination of NOx emission values for the four vehicles by "normalizing" them appeared to yield good data for computation of a final correction factor. This process eliminated the effect of differing NOx emission magnitudes among the test vehicles by transforming the data to ratios of "as measured" values vs. "best predicted" values at a standard humidity. Use of a greater number of vehicles would be desirable for any future research aimed at improving the statistical basis for light-duty diesel emission correction factors. Such a program ideally should make use of production vehicles only, rather than a mix of prototypes and production vehicles as used for this study.

by Charles T. Hare; Ronald L. Bradow
Southwest Res. Inst.; Environmental Protection Agency
EPA-68-02-1777
Rept. No. SAE-770717; 1977; 24p 9refs
Presented at Off-Highway Vehicle Meeting and Exhibition, Milwaukee, 12-15 Sep 1977.
Availability: SAE

HS-024 373

STEERING GEAR OVERHAUL. THE RECIRCULATING BALL TYPE

A detailed look at the step-by-step overhaul procedure of a representative ballltype steering gear is presented. This type of steering gear, the most popular type in use on American-built cars and trucks, features a mechanical element (the recirculating balls) that offers a low-friction, high-efficiency power transfer between the steering gear shaft and the vehicle's pitman arm. The basic gear assembly is used in both manual and power assisted application; it is dependable and durable, but sooner or later wear at the moving parts appears and replacement parts may be required. Servicing procedures are outlined for General Motors' Saginaw Steering Gear Div. steering gear assembly used in manual steering systems, but the instructions are generally applicable to comparable assemblies offered by Ford and Chrysler.

by Herb Carrier
Publ: Brake and Front End v48 n10 p21-4 (Oct 1978)
1978; 1ref
Availability: See publication

HS-024 374

ELECTRIC VEHICLE DEVELOPMENT. INTERNATIONAL CONFERENCE. 31ST MAY-1ST JUNE [1977]

A compilation of papers (and discussions thereof) given at a London meeting to consider the work involved in the immediate introduction of electric road vehicles, is presented. An international audience of some 300 delegates, from 19 countries, represented manufacturers, research organizations, government agencies, transportation managers, and urban authorities. The meeting was organized by the Electric Vehicle Devel. Group, with the support of Electronics and Power, The Chartered Inst. of Transport, Design Council, Mobility Trust, Electrical Res. Assoc., International Union of Producers and Distributors of Electrical Energy, and Lead Devel. Assoc. Papers presented deal with battery power and economics, operational systems and supply networks, engineering design and the power source, test programs (fleet and individual vehicles), and international activities. It was generally agreed that a significant proportion of current road vehicles could be replaced using current electric vehicle technology.

Electric Vehicle Devel. Group, 59 Colebrooke Row, London N1 8AF, England
Rept. No. PPL-14; 1977; 112p refs
Supported by Electronics and Power, the Chartered Inst. of Transport, Design Council, Mobility Trust, Electrical Res. Assoc., International Union of Producers and Distributors of Electrical Energy, and the Lead Devel. Assoc. Includes HS-024 375--HS-024 390.
Availability: SAE

HS-024 375

PROSPECTS FOR IMPROVEMENTS IN LEAD-ACID BATTERIES

An assessment is made of means to improve the energy density, maintenance, and rechargeability of lead-acid batteries for use in electric vehicles (EV's). Lead-acid batteries are the only currently available economical power source of proven reliability, but their energy density limits the range of practical EV's to less than 100 miles under a wide range of operating conditions. Recharging time is measured in hours rather than minutes. The combination of these factors makes battery-powered vehicles unattractive to a high proportion of potential purchasers. In addition, there are some maintenance tasks, particularly the addition of water to each cell, which some users find tedious and which, when not done correctly, reduce battery life. The technology to produce lead-acid batteries of adequate durability and with an energy density of 45 W-hr/kg in 5 hr is under development and will be available on a commercial scale within the next five years. These modest claims may be exceeded if some of the more intractable problems of active-material utilization are solved. The possibility of improvement up to 50 W-hr/kg exists and there is a reasonable expectation that this will be achieved in the next five to ten years. For short cells there has been successful marketing of small maintenance-free batteries, where successful cycling up to at least 200 cycles has been achieved with an insignificant amount of gas evolution and hence water loss. For taller cells, the answer lies in automatic or semi-automatic watering systems, several forms of which already have been developed. Some systems operate on floats but it is believed that an air-lock system is preferable as it does not require any moving parts and is therefore more reliable. The advantages claimed for rapid recharging are somewhat illusory and the technology needed to achieve this is likely to be both expensive and difficult.

by R. G. Acton; P. Sutcliffe
Oldham and Son Ltd., Denton, Manchester, England
Publ: HS-024 374 (PPL-14), "Electric Vehicle Development. International Conference," London, 1977 p3-5
1977; 5refs
Conference held in London, 31 May-1 Jun 1977.
Availability: In HS-024 374

HS-024 376

THE ENERGY AND RESOURCE IMPLICATIONS ASSOCIATED WITH THE WIDESPREAD USE OF ELECTRIC VEHICLES

The comparative economics of internal combustion engined (ICE) and battery electric vehicles (cars and light goods vehicles) is considered by analyzing the efficiency with which the two options use energy and other material resources. Cash cost comparisons are also attempted. It is shown that battery energy density is of crucial importance to the viability of electric vehicles (EV's). Given the expected development in battery technology over the next 25 to 30 years, EV's will show a clear energy advantage over an ICE vehicle fueled on a liquid derived from coal. Because of the interaction between the demand for energy by transport and other sectors of the economy, widespread use of EV's could lead to a lower total energy demand by the U.K. and require a smaller electrical generating capacity. EV's are likely to show a cash cost advantage. Electric cars are not likely to replace ICE cars on a journey-for-journey basis over the next 40 or more years because of their range limitation, but favorable changes in the patterns of land use and public transport facilities could help the electric car. Probably the single most important commercial factor in the choice between ICE's and EV's is the choice made by other countries. Vehicle manufacturers will prefer to produce vehicles which can be sold on world markets, not only in the U.K. The manufacture of vehicles in the U.K. generates a demand for imported goods and materials and the widespread use of

electric vehicles will not seriously affect the situation if the changeover to a new vehicle technology takes place over a period of years (e.g. 25 years).

by G. Charlesworth
Open Univ., Energy Res. Group, Milton Keynes, England
Publ: HS-024 374 (PPL-14), "Electric Vehicle Development. International Conference," London, 1977 p6-13
1977; 4refs
Conference held in London, 31 May-1 Jun 1977.
Availability: In HS-024 374

HS-024 377

RECENT DEVELOPMENTS IN POWER SOURCES WITH SPECIAL EMPHASIS ON ALKALINE BATTERIES

The requirements for batteries for use in electric vehicles (EV's), and the state of development of such batteries which contain aqueous electrolytes (batteries with lead-oxide electrodes, nickel-zinc batteries, nickel-iron batteries, metal-air batteries (iron-air, zinc-air), nickel-hydrogen cell, lithium-water-air battery) are discussed. Taking into consideration such factors as the relationship among battery payload, power capability, and energy density; the dependence of the energy content of a vehicle battery on the infrastructure of electricity distribution; the required operating distances; and the simple design necessary for reasons of cost, batteries with aqueous electrolytes can certainly be regarded as possible propulsion batteries for EV's. The necessary energy densities in the region of 40 W-hr/kg to 60 W-hr/kg at the 2-hr discharge rate, and power densities of more than 70 W/kg to 80 W/kg, are expected to be achieved with such batteries. More development of the batteries is required. An advanced stage of development already has been reached with nickel-zinc and nickel-iron systems, particularly the latter. However, the probability of using these batteries depends on whether they can be manufactured at a reasonable cost, and on whether they meet the economic requirements for vehicular use. The transportation costs which can be expected with use of these batteries are roughly comparable to the costs which apply to conventional vehicles. The state of technical development and economic aspects support the view that batteries with energy densities between 40 W-hr/kg and 60 W-hr/kg will become the energy sources for a first generation of EV's.

by H. G. Plust
Deutsche Automobilgesellschaft m.b.H., Res. Lab., Esslingen, Germany
Publ: HS-024 374 (PPL-14), "Electric Vehicle Development. International Conference," London, 1977 p14-24
1977; 30refs
Conference held in London, 31 May-1 Jun 1977.
Availability: In HS-024 374

HS-024 378

THE ROLE OF THE BATTERY ELECTRIC VEHICLE

The battery electric vehicle (EV) has the same energy requirements for propulsion as does the gasoline-powered motor vehicle, but it contains an energy store necessarily limited to the equivalent of about one gallon of gasoline which takes several hours to recharge (two recharges in a 24-hr period), thus allowing for a maximum range over 24 hours equal to that supplied by the equivalent of two gallons of gasoline. However, it is important to recognize that many vehicles are used in a way that is entirely consistent with these parameters, in particular, Post Office vans, light goods vehicles, and urban buses. This regimented use pattern of short mileage service followed by long recovery periods is quite unsuited to the personal automobile. When petroleum becomes very scarce, the battery EV will be most suitable for meeting transportation needs in the form of delivery and service vehicles. An electric vehicle is simpler to maintain but not initially cheaper than a gasoline vehicle. Until it is produced in comparable quantities, its price cannot be compared to the gasoline-driven equivalent. Even then, it will still be more costly because of the reinforced chassis and suspension necessary to handle battery weight. The Electricity Council Res. Centre has designed and tested a conversion of a Bedford CF van which uses a series motor with a battery scanning controller and a Hobbs VKD hydraulic transmission. The vehicle has an acceleration of from 0 mph to 30 mph in 12 seconds and a top speed of 50 mph. This type of vehicle is capable of providing the same service as its fleet gasoline-powered counterparts. The sodium-sulfur battery of the Electricity Council is now being developed as a 100 kW-hr motive power battery suitable for vans and buses. The successful development of this battery seems now assured; it will offer at least a 5/1 improvement in volume and weight over the lead-acid battery, with corresponding benefits in daily range and payload.

by G. Ratcliff
Electricity Council Res. Centre, Capenhurst, Chester CH1 6ES, England
Publ: HS-024 374 (PPL-14), "Electric Vehicle Development. International Conference," London, 1977 p29-30
1977
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Availability: In HS-024 374

HS-024 379

SUPPORT SERVICES FOR ELECTRIC VEHICLES

A general examination is made of what could be involved in providing an energy replenishment service for electric vehicles (EV's) alongside the existing system for gasoline-powered motor vehicles. Attention is directed solely to the electric passenger car. The first of two alternative systems for energy replenishment involves multiple charging points where vehicles could recharge their batteries from a connection to the normal domestic or commercial electrical distribution system wherever a suitable outlet is readily available. The owner could carry a simple charger as an integral part of the EV to provide the flexibility of using similar outlets at different locations. The availability of the outlets could, however, be a major drawback to this system. For example, in the U.K. it is estimated that 18% of private cars might not have ready access to an existing electrical outlet at night. Other disadvantages of such a system include lack of flexibility (i.e. time availability of the EV), no control of battery charging and conditioning to maximize battery life, no provision of spares and no servicing facilities at point of energy replenishment, and safety hazards associated with either the establishment of many unattended electrical outlets or with providing adequate venting during charging in a confined garage space. An alternative method of exchanging batteries at central stations can overcome these disadvantages, but the conception of these stations is more complex. However, no insurmountable technical or social problems have been identified with EV exchange stations. A large degree of standardization is required for battery specifications in order that a universal type of exchange station could be developed. There are many difficulties inherent in develop-

ing battery standards and in determining battery ownership. Technical problems are associated with a need to reduce the charging period and with the design of a fully-automated handling and charging system. The cost of a battery exchange station by today's prices inevitably must be higher than for an equivalent gasoline station. These costs, however, can be minimized by studying the interrelationships among the design and operation of the car, the battery, and the station; all three areas must be developed in parallel.

by M. Bradford; B. Buss
Electrical Res. Assoc. Ltd., Cleave Rd., Leatherhead, Surrey, England
Publ: HS-024 374 (PPL-14), "Electric Vehicle Development. International Conference," London, 1977 p31-6
1977; 9refs
Conference held in London, 31 May-1 Jun 1977. Paper based on a report sponsored by Transport and Road Res. Lab. (England).
Availability: In HS-024 374

HS-024 380

ELECTRIC VEHICLES--CAN THEY BE FITTED INTO URBAN BRITAIN?

The prospects for electric vehicle (EV) usage in Great Britain, particularly in London, are considered. The range, flexibility, performance, and availability of internal combustion engined (ICE) vehicles present a formidable challenge. Moreover, the dependence of contemporary electricity production in the U.K. on fossil fuels and the presently questionable overall environmental advantage of EV's are such that an order of magnitude improvement in electric battery vehicle technology (ebvt) is needed if it is to become common in this century. A spectrum from pure EV's through hybrid vehicles to pure ICE vehicles, matched to a range of transport tasks, from the light and local to the heavy and long-range, is more probable than an all-electric future. The characteristics of urban car use lead to the following performance requirements for a popular electric car: range, 100 km; cruising speed, 75 kph; acceleration, 0 kph to 65 kph in 10 sec; climbing, 40 kph on an 8% gradient. This electric car would need to be complemented by a convenient system whereby high-performance ICE or hybrid vehicles could be rented for occasional use. For "second cars", the cruising speed could be reduced to 65 kph and range to 80 km. The urban electric taxi looks like a possibility only if the trade can be organized to provide general, fast battery-pack exchange services and a corresponding degree of vehicle standardization. Should that be the case, the taxi's performance requirements would be as follows: range, 100 km (cruising range 130 km); cruising speed, 65 kph; acceleration, 0 kph to 45 kph in 8 sec; and climbing, 40 kph on a 5% gradient. The case for bus electrification is not as strong. In normal operation a bus would have to be capable of 180 km/day, but in a mixed fleet this could be reduced to 100 km (130 km cruising); acceleration requirements would be 0 kph to 30 kph in 12 sec, and 0 kph to 50 kph in 30 sec. The goods vehicle fleet is a limited ebvt candidate; suggested performance requirements are as follows: range, variable by type up to 100 km; cruising speed, 65 kph; and acceleration, 0 kph to 45 kph in 8 sec (light goods vehicle) and 0 kph to 45 kph in 14 sec (medium goods vehicle). Current ebvt will not allow any of the EV specifications to be met. The demands of urban taxi and bus use mean that there is no real prospect of current ebvt being able to compete with the diesel engine. There is a possibility for limited parts of the bus market, as well as of the trucking industry, being served by ebvt.

by D. Bayliss
Greater London Council, London, England
Publ: HS-024 374 (PPL-14), "Electric Vehicle Development. International Conference," London, 1977 p37-45
1977; 35refs
Conference held in London, 31 May-1 Jun 1977.
Availability: In HS-024 374

HS-024 381

ROAD VEHICLES WITH COMBINED, AT LEAST PARTLY ELECTRICAL DRIVING SYSTEMS AND ENERGY SUPPLIES

Options for hybrid road vehicles in which part of the propul sion system is electrical (overhead wires or batteries) are con sidered, and some of the variants are described. These vehi cles take into account trip characteristics (electrical drivin system for short trips vs. liquid-fuel-operated systems for lon trips), varying environmental conditions (city vs. country po lution levels), and the necessity to save and/or substitute f petroleum. The hybrid vehicles are distinguished by higher ir tial expenditures but offer savings in fuel consumption. promising concept seems to be an internal combustion e gine/battery-electric hybrid. Many variants of this combinati are possible which ultimately are distinguished from ea other by their range of operation, exhaust emissions, and f consumption. No general recommendations can be made, t decision has to be based on individual circumstances. So f there are no long-term tests being performed; this would the only way to make any generalizations.

by H.-G. Mueller
GES Gesellschaft fur Elektrischen Strassenverkehr m.b.H., Germany
Publ: HS-024 374 (PPL-14), "Electric Vehicle Development. International Conference," London, 1977 p48-52
1977; 9refs
Conference held in London, 31 May-1 Jun 1977.
Availability: In HS-024 374

HS-024 382

ELECTRIC VEHICLE DESIGN--NOW

Since there is considerable opportunity in the field of electri vehicles (EV's), ElecTraction Ltd. (England) has elected t develop EV's for the so-called leisure market. The trend in th U.K. is for the middle-class young, aged 20 to 24, and th older middle class, aged 45 to 65, to live in the cities; these groups and, to a greater extent, the 65 and over age group are less enthusiastic owners of automobiles than the national average. The young group lives a rather localized life; the older groups only travel relatively short distances and hire vehicles at weekends or use taxis. In urban areas, an increasing number of people live closer to work and, as the reliance on public transit grows, the role of the electric leisure vehicle will gain considerable support. The resort areas will by natural evolution be dominated by EV's, possibly with bans on internal combustion engined vehicles in certain areas by 1980. With the increasing allocation of leisure time and earlier retirement, the market offers considerable potential and one which probably will not be entered by large auto companies. It is ElecTraction's intention to develop electric leisure vehicles to cover a widening spectrum of activity, with definite develop-

ment in three closely related areas, slow-speed (novelty vehicles such as its Rickshaw model and others mainly for off-highway use), high-speed (vehicles such as its Tropicana model for use on the highway), and general-purpose (vehicles such as its Precinct model). With the planning moves currently being contemplated, ElecTraction is confident that it will grow over the next 12 months into a 30 million pound business, and that it will make a small, if not insignificant contribution to establishing an EV market on which to expand. Included in expansion plans is the production of commercial vehicles, such as postal service vehicles.

by Roy D. Haynes
ElecTraction Ltd., England
Publ: HS-024 374 (PPL-14) "Electric Vehicle Development. International Conference," London, 1977 p53-6
1977
Conference held in London, 31 May-1 Jun 1977.
Availability: In HS-024 374

HS-024 383

AN ELECTRIC WHEEL MOTOR UNIT APPLIED TO TWO WHEELED VEHICLES

An electric scooter lends itself to in-wheel propulsion more readily than larger electric vehicles, and the means by which this may be achieved are described. Test results on a prototype machine indicate the performance to be expected, and the scope for altering the machine's design and characteristics is discussed. Although a prototype electric scooter is yet to be constructed, valuable design information has been acquired by testing a suitable "pancake" motor on a somewhat lighter bicycle. It has been determined that a motor continuously rated at 400 W will be sufficient to propel a scooter at 50 kph, and this speed seems to be reasonably compatible with the range that would be achieved using three 12 V batteries. To manufacture the direct-drive motor involves processes that have not been common for electric machines in the past. The prototype motor is quite complex to adapt to mass production, though the more recent version developed for the bicycle wheel involves much simpler and less costly manufacturing techniques. It can be expected that a scooter propelled by a 36 V direct wheel motor will have a range of around 50 km, and it may be controlled using either stepped or variable speed control. A restricted range and speed compared with internal combustion engined scooters is inevitable. The direct-drive wheel motor offers a simple means of propulsion, freeing the scooter from any form of conventional transmission system.

by P. Campbell
University of Cambridge, Dept. of Engineering and Downing Coll., England
Publ: HS-024 374 (PPL-14), "Electric Vehicle Development. International Conference," London, 1977 p57-62
1977; 2refs
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Availability: In HS-024 374

HS-024 384

THE FLEET OPERATOR'S VIEWPOINT [ELECTRIC BUSES]

The philosophy behind the development and the results of two years' operation of two prototype electric buses by the Greater Manchester Transport, England, are discussed. While it was accepted that there were limitations on the usefulness of electric vehicles (EV's) because of existing battery technology, the company considered that there were major development hurdles to overcome in order to further the design of the associated equipment to meet improvement in battery design. The single-deck bus selected was a Seddon RU chassis of standard length. With Chloride as the prime partner, this vehicle was fitted with a 72 kW motor by Electro Dynamic Construction and a controller designed by Sevcon. The vehicle had the equivalent performance of an internal combustion engined vehicle; and to maximize the range, regenerative braking was incorporated. In addition, an electric midibus was designed by Lucas using a Seddon Pennine chassis with Lucas motor and control gear, and incorporating regenerative braking, for specialized city-center operation. The Chloride Silent Rider completed 3500 mi in operational service, and 1000 demonstration mi, and matched the performance of equivalent diesel buses. The electric bus also was preferred by passengers, particularly because of its smoothness and lower noise levels. However, the vehicle availability was less than 50% vs. an average of 80% for diesels. The main cause of failure was the controller unit, the major new development in the bus, and in particular the regenerative braking feature. The Lucas midibus gave a somewhat better performance, but still had a less than 50% availability because of failures related to regenerative braking and to experimental batteries designed for weight reduction. The experimental program has shown that it is possible to operate EV's within a large bus fleet. Although the results are superficially disappointing, they were not altogether unexpected and do give some guidance for future electric passenger vehicle development. To determine the economics of such operation, further research should incorporate a reasonable number of test vehicles, specialized power-pack equipment to give rapid recharging and the possibility of extensive off-peak charging, specialized garage facilities to accommodate EV's, and trained servicing staff.

by A. M. Munro
Greater Manchester Passenger Transport Executive, County Hall, Piccadilly, Manchester, England
Publ: HS-024 374 (PPL-14), "Electric Vehicle Development. International Conference," London, 1977 p64-7
1977
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HS-024 385

DEVELOPING ELECTRIC VEHICLES

The history of Lucas Batteries Ltd. (England) involvement in the development of high-performance electric vehicles (EV's), which began in 1968, is outlined. It was felt that by developing the lead-acid battery system to provide a battery of higher specific energy with adequate deep cycle life, a viable commercial vehicle could result. The first commercial vehicle conversion carried out for testing was a Bedford CA pickup. Information both on the performance of the electrical drive system, and on the performance necessary for the vehicle to be compatible with urban traffic was obtained and was used in the design of the traction motor and the control system in the next vehicles to be converted, two British Leyland 250 JU vans, built purely as research vehicles. In 1974, a considerable number of development vehicles were built in order to obtain practical in-service experience. The first of these vehicles were converted from Bedford CF vans, and were designated CF1 and CF2. Of the six CF2 vehicles put in service, one has been used very successfully on newspaper delivery service, the remainder with the Post Office. The 12 CF1 vans were

next put into service, some with the Post Office, some with a large fleet operator familiar with EV's, another with London Airport, and one retained for worldwide demonstration purposes as a luxury personnel carrier. Over 520 vehicle weeks service has been achieved with these vehicles, in addition to a very considerable amount of service by the Lucas electric midibus. Soon after the first electric Bedford CF prototypes were built, it was decided to build the first of two taxis to enable costing exercises. The taxis were designed to meet strict police requirements, and have proven efficient but expensive. The CF1 and CF2 vans were not viable either; they were not so efficient and the design was not adaptable to existing production lines. The search to find a way of incorporating the efficient drive system of the taxi into a standard vehicle, while preserving the relatively low cost of the latter by keeping changes from standard production to a minimum, led to the latest generation of vehicles, the CF3 EV's. The development of a commercially viable EV requires a total systems approach. Successful development of battery chargers, fuel gauges, and vehicle heaters is vital to assure general acceptance. Safety factors must be considered, particularly in regard to their relative silence (danger to pedestrians), electronic controller (affecting cardiac pacemakers), and possible battery explosion. Simulated and in-service testing over prolonged periods and in a variety of environments, is necessary, as is an efficient servicing organization. High-performance EV's have a secure future, but at the present stage of development, it is not possible to solve the problems of producing viable electric private cars for the U.K. market. Lucas' current development work is centered on solutions to short-term problems, in an effort to progress towards a longer-term and greater objective.

by G. G. Harding
Lucas Batteries Ltd., Birmingham, England
Publ: HS-024 374 (PPL-14), "Electric Vehicle Development. International Conference," London, 1977 p68-78
1977
Conference held in London, 31 May-1 Jun 1977.
Availability: In HS-024 374

HS-024 386

LATEST DEVELOPMENTS IN SPONSORED TEST PROGRAMS FOR ELECTRIC VEHICLES IN FRANCE

France's objective in developing an electric vehicle (EV) industry is to manufacture and sell enough EV's so that by 1985-1990 they would constitute a significant portion of the total car population. During the first phase of the development program (1971-1973), Electricite de France concentrated on resolving numerous problems associated with battery-powered electric vehicles, testing primarily on Renault 4 cars. Overall tests yielded valuable information concerning batteries, chargers, motors and electronics. In addition, Electricite de France commissioned the manufacture of nine electric buses, four intended for long-term testing in three new towns in the Paris area. Studies and construction of EV components were also sponsored. A determination was made that the constraints of lead-acid batteries would virtually eliminate private passenger cars, but that vans of 100-200 kg payload, trucks of 800 kg, and buses and highway cleaning vehicles such as garbage trucks (all such vehicles operating in an urban area) could be manufactured and marketed. In the second phase, 1973-1975, Electricite de France strove to induce manufacturers to study and promote EV development. A cooperative agreement was made with Regie Renault and with RWE, West Germany. An Oct 1975 conference of representatives of government, manufacturers and public transport adopted the principle of state-subsidized orders on the basis of definite specifications. The performance characteristics of vehicles equipped with lead batteries precludes extensive manufacturing of private passenger vehicles and such manufacture is not envisaged at present. Industrial vehicles for goods transport could be highly satisfactory in cities, and should be fleet-operated initially to facilitate maintenance. A competition was launched in Oct 1976, open to all manufacturers as long as the products were manufactured in France, for proposals for production of EV's (small vans and trucks, special vehicles such as sweepers, light garbage trucks). Efforts have been made to promote the use of electric buses through information and demonstration. Electric garbage trucks have operated in France for some years; operating results show that these vehicles are slightly more expensive to purchase than internal combustion engined vehicles, but are ultimately more advantageous because of low maintenance costs and an extended amortization period. Loans to facilitate purchase of such vehicles are envisaged. Electric propulsion is seen for lake, canal, and river boats. Access to recharging facilities would contribute to EV development, and the availability of a large number of access points to the public power supply must be contemplated. These must include simple metering and payment devices. Consultation with German and British authorities, and with the European Economic Community (EEC), is taking place. France fully approves the EEC suggestion that there should be a European Association for the development of EV's. French public authorities are aware of the advantages of EV's in improving urban living conditions and saving energy and foreign exchange.

by J. Gallot
Electricite de France
Publ: HS-024 374 (PPL-14), "Electric Vehicle Development. International Conference," London, 1977 p79-84
1977
Conference held in London, 31 May-1 Jun 1977.
Availability: In HS-024 374

HS-024 387

ELECTRIC CAR PROJECT OF THE EINDHOVEN UNIVERSITY OF TECHNOLOGY [THE NETHERLANDS]

In 1973, a multidisciplinary university research group (electrochemistry, electromechanics, transportation research, industrial design) undertook a project to develop an electric passenger car which would be pleasant and safe to drive in suburban use and to and from work. The project is described in terms of meeting the following requirements: top speed over 80 kph; cruising speed 50 kph to 70 kph; acceleration comparable to that of urban traffic, i.e. at least 1.5 m/sec/sec up to 50 kph; range of 100 km; rapidly exchangeable battery pack (lead-acid battery); active safety (good road holding, handling, and suspension); passive safety (low deceleration under frontal impact, due to controlled buckling over a sufficient length without the battery pack being reached); and 2 plus 2 passenger capacity (two adult passengers with luggage or with two children). A full-scale mock-up is being built at the present time. It is hoped that tests with different drive systems in the

prototype vehicle will start in 12 to 18 months. Full reports of the test results will be published.

by W. A. Koumans
Eindhoven Univ. of Technology, Eindhoven, Netherlands
Publ: HS-024 374 (PPL-14), "Electric Vehicle Development. International Conference," London, 1977 p87-90
1977
Conference held in London, 31 May-1 Jun 1977.
Availability: In HS-024 374

HS-024 388

AN ELECTRIC PROPULSION SYSTEM FOR A TOWN AND CITY BUS

The Power Electronics Lab. of the Dept. of Electrical Engineering, Delft Univ. of Technology (Netherlands) is involved in a research program to develop a power converter characterized by a controlled transfer and transformation of electric energy through resonant circuits at high internal power frequencies in excess of 10 kHz. An ideal converter for use in electric vehicles (EV's) should have unconditional reliability, low specific mass, and high efficiency. Small-scale converters of the above type have shown excellent properties in these respects; the feasibility of a specific mass better than 1 kg/kW has been demonstrated, and a conversion efficiency near 97% has been maintained at full power. It was therefore decided to design and construct an electric propulsion system suitable for use in vehicles and to install and test the system in a city transit bus. In the first phase of the project the main specifications for the system were determined on the basis of the standard diesel bus (i.e. acceleration in fully-loaded condition from 0 kph to 30 kph in 12 to 14 sec, maximum speed of 70 kph, and a payload of almost 7 tons (equivalent to 92 seated and standing passengers)). As the weight of the empty vehicle is about 9 tons, the fully-loaded bus will have a total weight of 16 tons. Because a load of 10 tons on the rear axle or 6 tons on the front axle cannot be exceeded, it was decided that the battery should be carried in a separate trailer. From the maximum vehicle weight (including a battery of approximately 6 tons), the dimensions of the components were then determined. The motor will be a separately-excited machine of 120 kW (continuous), controlled by two separate converters, a small one for the field and a larger one for the armature. It is intended that the large converter will be used only in the low-speed range; at higher speeds the armature of the motor will be directly connected to the battery so that the transition from driving to regenerative braking can be achieved smoothly and directly by increasing the field. This arrangement also allows currents in the braking mode which are appreciably higher than those for which the armature converter is designed. If it can be assumed that under peak-hour conditions the average total mass of the bus will be 20 tons, and given a six-ton battery, the range will be 46 km. Improvements in range might be made by adjusting driving style (limiting speed between stops, running with power off as much as possible, braking only when necessary, and improving the efficiency of regenerative braking).

by C. P. Keizer
Delft Univ. of Technology, Netherlands
Publ: HS-024 374 (PPL-14), "Electric Vehicle Development. International Conference," London, 1977 p91-2
1977
Conference held in London, 31 May-1 Jun 1977.
Availability: In HS-024 374

HS-024 389

TOWARDS A NEW GENERATION OF ELECTRIC VEHICLES

The development of electric vehicles (EV's) is considered from the utilities' point of view. Many of the problems remaining to be solved before there is wide use of EV's are related to poor energy storage possibilities. However, great progress has been made in all technological aspects of the electric car. Electro-motors are lighter and more efficient; semiconductor devices and elaborate mechanical drives have provided better control systems; bodies and chassis are lighter; roads are better, thus making suspension problems less difficult, and providing smaller rolling resistances. Presently, there exists a very good possibility for the use of EV's, mainly in city traffic. The most promising immediate use would seem to be the service vehicle, such as the municipal garbage truck and the door-to-door delivery van. EV's could provide fast-delivery services such as are currently undertaken by motorcycles/bicycles and mail delivery. It is estimated that in the period 1985-1990, some 10% of inner-city traffic in industrialized countries, and in cities with no very steep gradients, will be driven by electricity. This could mean about a 3% increase in the annual global production of electricity which should pose no problems. EV's are nonpolluting, an advantage especially in city traffic, and are noiseless, which, although an asset from the point of view of noise pollution, could present a danger to pedestrians initially. In cities, electric cars would take up less parking space because of their smaller size (2 or 3 times smaller than the conventional car). The energy used would allow city traffic to be independent of any possible petroleum embargo. A sometimes forgotten aspect is that electric power is paid for by the customer after it is used, not before. Considerable efforts are being made currently to promote EV's in the larger European countries, in the U.S. and Japan.

by F. Dierkens
International Union of Producers and Distributors of Electrical Energy, Group of Experts for Electric Vehicles
Publ: HS-024 374 (PPL-14), "Electric Vehicle Development. International Conference," London, 1977 p93-4
1977
Conference held in London, 31 May-1 Jun 1977.
Availability: In HS-024 374

HS-024 390

GOVERNMENT SUPPORT FOR THE ELECTRIC VEHICLE INDUSTRY

The main responsibility for the electric vehicle (EV) industry in the U.K. lies with the Dept. of Industry which is responsible for general industrial policy and for the industrial component of regional policy, including financial assistance to industry under the Industry Act 1972 and 1975 and the Science and Technology Act 1965. A substantial part of its Vehicles Div.'s time is devoted to the EV industry. Requests for assistance with research and development are considered by one of the Res. Requirements Boards which have been set up within the Dept. of Industry to deal with the various industrial sectors. All boards (drawn from industry, university, trade and research associations, government) are concerned that any project funded will bring ultimate benefits, and will improve the efficiency and competitiveness, in the world scene, of U.K. industry. In 1970, the Dept. ordered two battery electric buses designed for town-center operation to provide bus operators with a first-hand opportunity to assess the opera-

tional problems of EV use, and to gather engineering and performance data. The Dept. recently announced that it has allocated up to 400,000 pounds towards the cost of an assessment of electric delivery vehicles, to obtain independent operational experience and reliable, objective data on such aspects as true running costs, performance, duration, ease of repair, driver acceptability, energy consumption, and life of delivery vans in the range 0.75 ton to 2 tons payload in urban traffic. In 1974, a 2-year program was approved for research on sodium-sulfur electric storage batteries, primarily for traction applications. Other government support includes technical and administrative advice, dissemination of information, representation of the industry, and cooperation with other countries. In the U.S. there is a Federal program of research, development, and demonstration designed to promote electric and hybrid vehicle technologies and to demonstrate their commercial feasibility. Japan is developing prototype cars, buses, light trucks, and requisite batteries. In France there is development of city buses, commercial vehicles (Post Office, delivery vans, etc.), and batteries. The Federal Republic of Germany is promoting development of batteries, buses, and delivery vans. Sweden is concerned with test facilities for EV's and development of batteries; Brazil is studying the introduction of buses and trolleys; South Africa is studying the technological feasibility of EV's, and Australia, the development of battery electric cars (S. Australia).

by G. W. Wicken
Department of Industry, Vehicles Div., England
Publ: HS-024 374 (PPL-14), "Electric Vehicle Development. International Conference," London, 1977 p95-9
1977; 3refs
Conference held in London, 31 May-1 Jun 1977.
Availability: In HS-024 374

HS-803 240

HEAD AND NECK INJURY SEMINAR, ARLINGTON, VIRGINIA, 12 AND 13 APRIL 1977. A REPORT TO THE SECRETARY OF TRANSPORTATION

Recommendations of the Head and Neck Injury Seminar held on 12-13 Apr 1977 in Arlington, Va., which was sponsored by the National Motor Vehicle Safety Advisory Council, along with the summaries of pertinent discussions, are presented as guidelines for the Secretary of Transportation and the Administrator of the National Hwy. Traffic Safety Administration (NHTSA) for the review, modification, and, if necessary, establishment of new goals and objectives. The seminar was designed to bring together leading national and international experts in the head and neck injury field (biomedicine, biomechanics, protective systems, etc.) in order to discuss such topics as methods for identification of head and neck injury mechanisms and injury tolerance levels, relationship of mechanisms to pathology of injury, and factors necessary for valid surrogate assessment of safety system performance. Attention centered on six primary areas of head and neck injury research: injury mechanisms, impact tolerance, the role of surrogates, standardization of autopsy protocol, instrumentation advances, and helmet research. It was concluded that due to biological variations among the population, tolerance and response data are still needed for a clearer picture of what levels of acceleration are associated with the range of injuries sustained. There is a continuing need to understand more completely the mechanisms of injury to the brain and the soft tissues of the head and neck. The recent General Motors Hybrid III ATD (anthropomorphic test device) should be subjected to independent and objective evaluation to determine if the ATD response is human-like under various impact conditions. The principal complaint against the use of cadavers and anesthetized animals is the lack of neuromuscular response in these surrogates; however, their use in impact research should be encouraged, although the interpretation of the results require further study. The use of the Abbreviated Injury Scale (AIS) has provided a quantitative base for injury assessment. Continuing effort to refine the scale to develop a logical basis for assigning a whole-body AIS from various regional AIS values is desirable. A standard autopsy protocol and reporting procedure would provide significant information on injury severity and mechanisms of individuals that go unreported under present procedures. The design of restraint and safety systems should be based on injuries observed in the field. New ideas are required to quantify field accident data so that the cause of the observed injuries can be determined more accurately. Methods for helmet evaluation and headform design require a continuing effort. Increased knowledge about the properties of biological tissues is required for establishment of tolerance levels to injury, understanding of the mechanisms of injury, and material constants used in mathematical models. Future such seminars are recommended, as well as increased biomechanics funding by NHTSA.

by Kenneth J. Saczalski, ed.; Ruth E. Winkler, ed.; Harold A. Fenner, Jr., ed.; Albert I. King, ed.; John D. States, ed.; Ivan J. Wagar, ed.
National Motor Vehicle Safety Advisory Council, Washington, D.C. 20590
1978; 17p
Availability: Corporate author

HS-803 314

STATE ACCIDENT REPORT FORMS CATALOGUE. 1978 ED.

The various police traffic accident report forms used by the 50 states, the District of Columbia, Puerto Rico, American Samoa, Guam, Virgin Islands, and Quebec are presented. A listing of the current revision date for each state's form is included. Many states have upgraded or revised their forms since the original publication of the State Accident Report Form Catalogue in 1976. This publication will be updated and reprinted on a periodic basis to maintain its timeliness and relevance.

National Hwy. Traffic Safety Administration, Office of State Prog. Assistance, Washington, D.C. 20590
1978; 178p
Availability: Corporate author

HS-803 363

VEHICLE SELECTION MATRIX. FINAL REPORT

The Vehicle Selection Matrix was created as an aid in the selection of motor vehicles for compliance testing by the National Hwy. Traffic Safety Administration (NHTSA). A Vehicle Compliance-related data base has been established, as well as a generalized Vehicle/Test Selection Matrix Report which yields flexibility and specificity to the research utilization of the data. The system attempts to predict which vehicles are most likely to be in noncompliance given a specific Federal Motor Vehicle Safety Standard. It is the objective of the Office of Vehicle Safety Compliance, NHTSA, to test those

vehicles considered to be candidates for noncompliance or about which there is inadequate compliance information. A limited compliance test budget, an increasing number of vehicle models available for testing, and the need for more frequent use of other accessible automated data bases within NHTSA contributed to the timing of an automated system development. The Vehicle Selection Matrix System was created as an extension and enlargement of the initial manual system. The system was successfully demonstrated initially by the production of the FY1974 Vehicle Selection Matrix; since that time, the matrix successfully has produced the FY75, FY76, FY77, and FY78 Vehicle Selection Lists.

by B. Beddow; J. Peizer; B. Carpenter; J. DeGoes
Kappa Systems, Inc., 1501 Wilson Blvd., Arlington, Va. 22209
DOT-HS-7-01624
Rept. No. KAPPA-DOT-78-01; 1978; 171p
Rept. for 20 May 1977-1 Mar 1978.
Availability: NTIS

HS-803 367

THE RELATIONSHIP OF AUTOMOBILE CHARACTERISTICS TO LIST PRICES AND PROFIT MARGINS -- A PRELIMINARY ANALYSIS. FINAL REPORT

During research on potential impacts of fuel economy regulations on the U.S. automobile industry, a study was made of the possible effects of auto "down-sizing" on manufacture profit margins. Historical price data were used to estimate variable profit margins. Estimated margins were strongly correlated with vehicle inertia weight and the price of the average options packages and, to a lesser extent, were negatively correlated with production volume. Regression analyses were also performed to relate list prices to vehicle characteristics believed to represent valuable attributes to consumers. The results, although ambiguous, suggest that vehicle roominess, fuel economy, and power-to-weight ratio are positive influences on prices; so long as down-sized vehicles retain their earlier interior roominess and performance they can be priced at levels equivalent to their heavier counterparts. Further study with more extensive data is required for firm general conclusions to be reached. Detailed statistical data are appended.

by N. A. Cassella; F. T. Rabe
EIC Corp., 55 Chapel St., Newton, Mass. 02158
DOT-TSC-1311
Rept. No. DOT-TSC-NHTSA-78-30; 1978; 55p 15refs
Report for Nov 1976-Nov 1977.
Availability: NTIS

HS-803 376

DATA BASE DEVELOPMENT OF AUTOMOBILE AND LIGHT TRUCK MAINTENANCE. FINAL REPORT. VOLS. 1, 2, AND 3

The development of life-cycle maintenance costs for 212 sales-leading, 1970 through 1975, passenger cars and light trucks, both domestic and foreign, is described. These costs provide a data base for the Dept. of Transportation (DOT), which describes the costs for parts and labor for performing both the scheduled (manufacturers recommended) and typical unscheduled (replacement of worn-out parts) maintenance for each of these 212 vehicles. The data can be used by DOT to assess the impact of future regulatory requirements upon the owner's costs of servicing and repairing the vehicle. Where service work is performed during the vehicle life cycle (service station, general repair, car dealer, other) is defined. The automotive service industry is characterized by including the facility (building) costs, land requirements, tools and equipment requirements, inventories investment costs, and operating capital. The major types of service facilities which handle most of the commercial repair work are described. These establishments are representative of the 29,600 new car dealers, 86,200 gasoline service stations, 30,650 independent repair garages, and 12,280 specialty shops in existence in 1975. The policies used by the service industry in pricing replacement parts are presented. Detailed are the price discounting policies of the industry parts suppliers, including the automobile manufacturers and aftermarket parts manufacturers, as well as those of the parts distributors (jobbers, new car dealers, oil companies, and specialty shops). General trends in service establishments indicate that more sophisticated equipment and the growing number of imported cars will tend to increase the amount of service performed by car dealers. Periodic Motor Vehicle Inspection programs could also influence the maintenance market. The tire, battery and accessory dealers and mass merchandisers' service centers are expected to increase their share of the market through aggressive merchandizing. A shift of maintenance being performed by do-it-yourselfers to conventional service establishments would require major investments in service facilities. Service stations are the only establishment failing to show sales gain. The interest of the major oil companies to operate high-volume "gas only" service stations may continue. Vol. 2 presents the total cost summaries of Scheduled (manufacturers recommended) and Unscheduled (replacement of worn out parts) maintenance, and the Scheduled Maintenance Data Sheets for the life cycles of 212 sales-leading 1970 through 1975 passenger cars and light trucks, both domestic and foreign. Unscheduled (replacement of worn-out parts) Maintenance Data Sheets for the life cycles of 212 sales-leading, 1970 through 1975, passenger cars and light trucks, both domestic and foreign, are provided in Vol. 3.

by Donald A. Hurter; Nancy G. Gardella; Philip G. Gott
Arthur D. Little, Inc., Automotive Technology Group, Acorn Park, Cambridge, Mass. 02140
DOT-TSC-1047
Rept. No. DOT-TSC-NHTSA-78-25-(Vol-1,2,3); 1978; 3v 173refs
Rept. for Jun 1975-Dec 1977. Bound in 3 vols.
Availability: NTIS

HS-803 384

A MODEL STATE CLASSIFIED LICENSING PROGRAM. GUIDELINES FOR MOTOR VEHICLE ADMINISTRATORS

Guidelines are presented for developing a model classified driver licensing program which will enable a jurisdiction either to update its present program or to change from a nonclassified to a classified system. A classified driver license is a license indicating the holder has been examined and is qualified to drive vehicles of the classification(s) for which he applied. What counts is whether the individual is qualified to operate the vehicle being driven, not the driving purpose. The system of vehicle classification recommended for the licensing program is one which utilizes vehicle weight and type, as presently advocated by the American Assoc. of Motor Vehicle Administrators (AAMVA) and the National Hwy. Traffic

Safety Administration. This classification scheme is as follows: Class "A", any vehicle or combination of vehicles, including all vehicles under Classes "B" and "C", except motorcycles; Class "B", any single vehicle weighing over 24,000 lb GVW (gross vehicle weight), or any such vehicle towing a vehicle not in excess of 10,000 lb GVW, and any bus, and all vehicles under Class "C", except motorcycles; Class "C", any single vehicle not in excess of 24,000 lb GVW, or any such vehicle towing a vehicle not in excess of 10,000 GVW, except buses and motorcycles; Class "M", motorcycles, mopeds, motor-driven cycles; and Class "P", instruction permit (learner's permit) for any of the above classes. (Classified driver license systems currently in use by the U.S. military, and in Switzerland, Ontario (Canada), New York, Colorado, Massachusetts, and Illinois are provided for comparison purposes.) While it is recognized that some states may wish to retain a certain individuality in their driver licensing laws, reasonable uniformity is highly desirable and appears readily attainable. The design of this licensing program plan is such that, if followed, should assist in overcoming inherent problems of implementation. It should also present an interested jurisdiction with a generally acceptable outline for a successful program. Appendices cover a waiver certification program, definitions of and suggestions for licensing motorized bicycles, motor-driven cycles and motorcycles, a schematic of the AAMVA classified program, use of social security numbers in motor vehicle administration, and cost of implementation.

National Hwy. Traffic Safety Administration, Washington, D.C. 20590
1978; 33p
Prepared in cooperation with American Assoc. of Motor Vehicle Administrators.
Availability: GPO, Stock No. 050-003-00326-3

HS-803 385

INSPECTION GUIDELINES FOR MOTOR VEHICLES OF LESS THAN 10,000 POUNDS GROSS VEHICLE WEIGHT. GUIDELINES FOR MOTOR VEHICLE ADMINISTRATORS

A guide to critical safety components in motor vehicle systems and subsystems to be inspected on a periodic basis is presented for the use of state motor vehicle administrators. The following items are recommended for inspection on a periodic basis (light-duty vehicles, less than 10,000 lb gross vehicle weight): brake system, component brake inspection--wheel(s) and drum(s) removed (wheel bearings, caliper/wheel cylinder, drum(s)/rotor(s), lining(s)/disc pad(s), lines and fittings, master cylinder, pedal pressure, brake warning light, power booster, parking emergency brake, mechanical parts) and functional brake inspection: performance test (imbalance, stopping capability) and component inspection (lines and fittings, master cylinder, pedal pressure, brake warning light, power booster, parking brake, mechanical parts); wheel system (tires, wheels); steering and suspension system (ball joints/king pin, manual and/or power assist mechanism, linkage, stabilizers, steering wheel/column, shock absorbers, springs/torsion bars); fuel system (storage, supply, distribution, fire suppression); exhaust system: from manifold to tailpipe inclusive; lighting and signal system (headlamps, hazard warning lamps, stop lamps, tail lamps, turn signal lamps, license plate lamp(s), clearance/side marker lamps, reflectors, horn); visibility system (windshield, side and rear windows, rearview mirrors, defroster/defogger, wiper and washer); and body components (doors, floor pan, seat(s), front hood latch, safety belts, bumper(s), fender(s)). Appendices cover the national status of Periodic Motor Vehicle Inspection programs, sample ballots for component criticality, a letter of transmittal, general guidelines for completing the vehicle inspection ballot, criteria for component selection and a bibliography.

National Hwy. Traffic Safety Administration, Washington, D.C. 20590
1978; 53p 11refs
Prepared in cooperation with American Assoc. of Motor Vehicle Administrators.
Availability: GPO, stock no. 050-003-00329-8

HS-803 386

DISCLOSURE OF ODOMETER READINGS ON MOTOR VEHICLE TITLE DOCUMENTS. GUIDELINES FOR MOTOR VEHICLE ADMINISTRATORS

This guide for disclosure of motor vehicle odometer readings represents the consensus of the state motor vehicle community as being the best way to inform buyers of a vehicle's mileage and to document such mileage. It is recommended that al ownership documents contain the following statement in as signment or reassignment portions of the document, or separate document shall be attached to the ownership docu ment: I certify that the odometer reading is (fill in blank) mile and to the best of my knowledge, reflects the actual mileag of the vehicle described herein, unless one of the followin boxes is checked; the amount of mileage stated is in excess c 99,999 miles; or the mileage stated is not the actual mileage This statement shall be contained on the ownership documen If a separate form is used, it shall also contain the vehicl description and include transferee's name and address, date and other such information as a jurisdiction deems necessary The odometer disclosure statement must be carried through al assignments, reassignments, or other forms of ownership con veyance. In multiple transfers of ownership, each transfero must complete an odometer statement. Every Certificate of Title shall reflect the recorded odometer mileage on the face and also reflect a disclaimer statement such as the following: "The Department will not be responsible for false or fraudulent odometer statements made in the assignment of the Certificate of Title or for errors made in recording by the Department." If for any reason the mileage indicated on the face of the Certificate of Title is not the actual mileage, such Certificate will also contain a symbol denoting that the mileage indicated is in excess of 99,999 miles, or the mileage is not the actual mileage. It is recommended that all states uniformly adopt this procedure, that the National Com. on Uniform Traffic Laws and Ordinances make the odometer disclosure mandatory in the Uniform Vehicle Code, that a tamper-proof odometer be developed and installed on all new motor vehicles, that manufacturers add another digit or indicator to the odometer to record excess of 99,999 miles, and that receiving jurisdictions shall carry forward mileages as stated on foreign titles. A summary of state responses to the survey of state odometer disclosure procedures is presented. Appended are applicable parts of the Uniform Vehicle Code, Supplement II, 1976, Chapter 3; Dept. of Transportation/National Hwy. Traffic Safety Administration rulemaking, Part 580, Odometer Disclosure Requirements, 1 Aug 1977 (49FR38906); a suggested format for an odometer disclosure form; resolution of the 1977 American Assoc. of Motor Vehicle Administrators International Conference on odometer policy; suggestions for

stopping interstate odometer fraud (Western States Odometer Meeting 10r17 Aug 1977); and recommended references.

National Hwy. Traffic Safety Administration, Washington, D.C. 20590
1978; 53p 5refs
Prepared in cooperation with American Assoc. of Motor Vehicle Administrators.
Availability: GPO, stock no. 050-003-00328-0

HS-803 414

DISTRICT OF COLUMBIA MOTOR VEHICLE DIAGNOSTIC INSPECTION DEMONSTRATION PROJECT. FINAL REPORT, NOVEMBER 1977

A summary is given of the activities of the District of Columbia Diagnostic Inspection Demonstration project during 13 months from 1 Sep 1976 through 30 Sep 1977. The Project was part of a larger effort by the National Hwy. Traffic Safety Administration to investigate ways to provide better mechanical safety and to evaluate exhaust emissions of vehicles in use on the public roads. Included are descriptions of the program background and objectives, management procedures, data collection and planning, a summary of each technical report, and conclusions and recommendations. This research effort resulted in conclusions indicating the usefulness and general merit of the high throughput diagnostic inspection procedure to analyze safety and exhaust emission of passenger vehicles. A large amount of data, taken from 7491 vehicle safety inspections, was collected, organized and stored on magnetic tape for future analysis. An extensive data summary and an explanation of the project management plan, with program requirements and reports, are appended.

by J. T. Harmeling; E. R. Rucker; E. J. Hamilton; R. L. Wood
District of Columbia Dept. of Transportation, Office of Vehicle Safety Res., 301 C St., N.W., Washington, D.C. 20001
DOT-HS-5-01098
Rept. No. HS-5-01098(5)-39; 1977; 144p
Rept. for Oct 1976-Nov 1977. Prepared in coordination with Potomac Res. Inc., 7655 Old Springhouse Rd., Westgate Res. Park, McLean, Va. 22101.
Availability: Reference copy only

HS-803 415

TENNESSEE MOTOR VEHICLE DIAGNOSTIC INSPECTION DEMONSTRATION PROJECT EXTENSION 1977. FINAL REPORT

In an extension period granted to Project Auto/SEE, a Tennessee diagnostic inspection demonstration project, the specific objectives were to collect additional maintenance and repair records for vehicles that were participating in the original Auto/SEE program and reflected the long-term effects, to obtain experience with later model (1974-77) vehicles, and to demonstrate how the diagnostic concept could be incorporated into a typical safety lane operation. Based on the analysis of the data obtained, participating vehicles experienced higher overall costs than their counterparts in the control program. The data also show that as the number of previous inspections increased, the vehicle condition improved, and the benefits of the diagnostic program are still increasing after four inspections. It is concluded that the most appropriate application of the diagnostic inspection concept would be to limit diagnostic services to those vehicles with deficiencies detectable by reliable screening tests, and that every diagnostic inspection facility include at the management level at least one individual with engineering training, on-site to ensure that equipment maintenance, diagnostic procedures and general technical management are properly conducted. Proper operation of a large scale diagnostic system requires a data information system with machine storage and retrieval. Late model vehicles offer no unusual inspection problems, though the use of catalytic reactors to treat engine exhaust removes one diagnostic tool for analyzing engine performance. Successful consumer-oriented activities were a "Powder Puff Mechanics Course" consisting of a three-hour class including items common to periodic maintenance and service of an automobile, an arbitration program, and an effort at liaison with the major repair facility owners to invite cooperation.

by J. W. Hodgson; M. D. Broach; A. C. Condroski
University of Tennessee, Transportation Center, Knoxville, Tenn. 37916
DOT-HS-5-01041
Rept. No. TC-78-004; 1978; 108p
Availability: Reference copy only

HS-803 465

REFINEMENT OF FINITE ELEMENT ANALYSIS OF AUTOMOBILE STRUCTURES UNDER CRASH LOADING. VOL. 1: SUMMARY FINAL REPORT

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IIT Res. Inst., 10 W. 35th St., Chicago, Ill. 60616
DOT-HS-6-01364
1977; 27p 2refs
Rept. for 21 Jun 1976-1 Nov 1977. For abstract, see HS-803 466.
Availability: NTIS

HS-803 466

REFINEMENT OF FINITE ELEMENT ANALYSIS OF AUTOMOBILE STRUCTURES UNDER CRASH LOADING. VOL. 2: FINAL TECHNICAL REPORT

A finite element computer program for use in the static and dynamic analysis of vehicle structure, including sheet metal, in a crash environment was developed. The program consists of: large displacement, nonlinear static and dynamic, and elastic and plastic including strain-rate effect; with plate, three-dimensional beam and spring elements, and rigid links and a variety of three-dimensional beam end conditions; options of using either the explicit or implicit time integration procedures; and options of specifying stress, mass and center of gravity, and energy output. It was concluded that the analysis formulation, while somewhat novel, is a formally sound procedure and a proper and useful approximation technique for the dynamic analysis of beam and plate structures involving large deflections and rotations; that the program is a correct rendering of this analysis technique and provided accurate results with reasonable efficiency in comparison with available known solutions; and that, most important, the computer program is readily applicable to realistic vehicle structures and provides credible results for actual crash events as demonstrated by the simulations on the end-on barrier tests. The analysis and computer program is a substantial improvement over previous attempts at a finite element analysis of vehicle structures, and is a potentially valuable addition to the tools for the study of vehicle crashworthiness. The most important and potentially fruitful activity is in the immediate and continued application

to actual vehicles and crash events. Appended are the computer program input, program description and listings, and explicit moment-curvature relationship and strain rate effect.

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HS-803 467

FIELD TEST EVALUATION OF REAR LIGHTING SYSTEMS. FINAL REPORT

A study was undertaken to determine whether one or more of three experimental rear lighting and signaling systems would result in a significant reduction in rear-end collisions under actual traffic conditions. The experimental concepts were to provide a single center high-mounted stoplight at the approximate eye level of a following driver, the stoplight being positioned on the vehicle's trunk just beneath the centerline of the rear window and as a supplement to the normal stop lamps; to provide two high-mounted stoplights, one on each side of the trunk directly below the rear window, at the approximate eye level of a following driver, the stoplights supplemental to the normal stop and turn signal lamps of the vehicle; and to separate the presence lamp from the stop and turn functions of existing signal lamps of the vehicle, providing no redundancy. During a 12-month period, four groups (three concept and one control group) totaling approximately 2100 taxicabs participated in a field evaluation in the Washington, D.C. area. During this period, a total of 1470 accidents occurred, of which 217, or 15%, involved taxicabs being struck in the rear while in operation. The most significant finding is that taxicabs equipped with the rear lighting configuration involving the addition of a single center, high-mounted stoplight had less than half the rear-end collisions experienced by the control group. This reduction was achieved whether measured in terms of absolute number of frequency of accidents or in terms of accident rate per million vehicle miles. This finding is statistically reliable, with a probability of less than one in ten thousand that the result could occur by chance alone. In addition, the effectiveness of the single-light configuration was found to increase during nighttime operation and also under conditions where there was almost complete certainty that the stoplights were illuminated just prior to or at the time of impact. The mean cost to repair cabs with this rear lighting system was lowest, by an order of magnitude, among the systems tested, indicating that these accidents were less severe than accidents involving other stoplight configurations. The rear-end collision rates of the other two experimental groups were similar to that of the control group. A comparison of non-rear-end accidents indicated no statistical differences between either of the three experimental groups and the control group.

by Thomas B. Malone; Mark Kirkpatrick; Jeffrey S. Kohl; Clifford Baker
Essex Corp., 201 N. Fairfax St., Alexandria, Va. 22314
DOT-HS-5-01228
1978; 57p 19refs
Rept. for Jun 1975-Nov 1977.
Availability: NTIS

HS-803 569

A COMPILATION OF STEADY STATE AUTOMOTIVE ENGINE TEST DATA. FINAL REPORT

The experimental data presented were obtained in dynamometer tests of automotive engines used in the U.S. as part of a program to obtain engine performance data for determining fuel consumption and emissions (carbon monoxide, hydrocarbons, and nitrogen oxides) at steady-state engine operation modes. Each of the following engines was tested over its entire speed/load operating range: General Motors Corp. (1977 Buick 231 CID (3.79 Liter), 2 BBL; 1976 Chevrolet 85 CID (1.4 Liter), 1 BBL; 1976 Chevrolet 305 CID (5.0 Liter), 2 BBL; 1975 Chevrolet (Vega) 140 CID (2.3 Liter), 2 BBL; 1975 Chevrolet 250 CID (4.1 Liter), 1 BBL; 1975 Chevrolet 350 CID (5.74 Liter), 2 BBL; 1975 Chevrolet 350 CID (5.74 Liter), 4 BBL; 1975 Buick 455 CID (7.46 Liter), 4 BBL); Ford Motor Co. (1977 Ford 140 CID (2.3 Liter), 2 BBL; 1977 Ford 171 CID (2.8 Liter), 2 BBL; 1976 Ford 400 CID (6.56 Liter), 2 BBL; 1975 Ford 140 CID (2.3 Liter), 2 BBL; 1975 Ford Windsor 351 CID (5.75 Liter), 2 BBL); Chrysler Corp. (1977 Chrysler 225 CID (3.69 Liter), 2 BBL; 1977 Chrysler 318 CID (5.21 Liter), 2 BBL; 1976 Dodge Colt 97.5 CID (1.6 Liter), 2 BBL; 1975 Chrysler 225 CID (3.69 Liter), 1 BBL; 1975 Chrysler 318 CID (5.21 Liter), 2 BBL); American Motors Corp. (1975 AMC 258 CID (4.23 Liter), 1 BBL); and foreign manufacturers (1977 Volvo 130 CID (2.1 Liter), F.I. (fuel injection); 1975 Honda CVCC 90 CID (1.48 Liter), 3 BBL; 1975 Mazda Rotary 70 CID (1.15 Liter), 4 BBL; 1975 Mercedes (Daimler)-Benz Diese 183.4 CID (3.0 Liter), F.I.; 1975 Mitsubishi (Chrysler) Diese 331 CID (5.43 Liter), F.I.; 1975 Nissan (Datsun) 119 CID (1.95 Liter), 2 BBL; 1975 Nissan (Datsun) Diesel 198 CID (3.25 Liter), F.I.; 1975 Perkins Diesel 247 CID (4.0 Liter), F.I.). The test results proved to have sufficient repeatability to establish steady-state maps for fuel consumption and emissions over the entire operating range of the engine. These data are useful for estimation of fuel economy and emissions for engineering calculations involving ground transportation.

by James A. Kidd, Jr.; Ralph G. Colello
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Rept. No. DOT-TSC-NHTSA-78-40; 1978; 270p 25refs
Rept. for Jun 1976-May 1978.
Availability: NTIS

HS-803 570

PUBLIC ATTITUDES TOWARD PASSIVE RESTRAINTS. FINAL REPORT

A nationwide study of public attitudes toward automobile safety was conducted which involved interviews with 2016 adult Americans who are either licensed drivers or who live in households with at least one automobile. The survey, conducted during the period 17-27 May 1978, explored a broad range of subjects relating to automobile safety including public concern about automobile safety and perception of the need to protect car passengers from crash injury; public attitudes toward currently available safety equipment, particularly the active safety belts; attitudes toward new rules requiring passive restraint systems in new cars for crash protection; and public expectations about the technology and use of new passive restraint systems. Some of the key observations from this survey are as follows: considerable concern was expressed regarding the possibility of being injured in an automobile ac-

cident; seat belts were used all or most of the time by only a quarter of the U.S. population; there was belief, by a two-to-one margin, that the government should require automatic crash protection in new cars rather than encourage greater seat belt use; there was general agreement with the Secretary of Transportation's decision to require passive restraints in new cars; air bags were much better known than automatic seat belts; the public was divided in its preference for air bags or automatic belts, with price being only a marginal consideration; air bags were rated above automatic or active belts for their safety protection, comfort, appearance, and ease of use; public were generally favorable to government auto safety regulation, believing that government regulators have the public's interest at heart; and there was belief that many major industries should have a great deal of regulation to protect public safety.

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DOT-HS-8-01953
1978; 228p 2refs
Rept. for May-Aug 1978.
Availability: NTIS

HS-803 575

SAFETY BELT PROBLEMS: NHTSA [NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION] IN-HOUSE SURVEY

A total of 1186 complaints were received from owners of 715 motor vehicles in a National Hwy. Traffic Safety Administration (NHTSA) in-house survey to collect data on safetybelt usage problems. The complaints were analyzed, categorized, and classified by seatbelt component, vehicle model, model year, and vehicle manufacturer. Complaints were also classified by four major problem areas: broken or defective safetybelt components (buckle, webbing, retractor, guide ring, anchorage, and adjustment mechanisms), difficulty in using or locating seat belt, discomfort in wearing seat belt, and hazards in the belt system. More than 1000 consumer letter complaints received by NHTSA were also analyzed for comparison with the in-house data source. To verify the survey findings and to determine the rate of safetybelt problem corrections, a telephone follow-up survey was performed. From the analysis of the seatbelt complaints from the in-house survey and the complaint file, it was found that difficulty in using or locating the seat belt (as reported in 39.7% of the 715 vehicles) and discomfort in wearing the seat belt (29.4% of the 715 vehicles) are the two major factors discouraging use. The malfunction, failure, or defect of seatbelt components could reduce or eliminate the degree of protection afforded by safety belts; for example, a broken anchorage bolt prevents the safety belt from holding the occupant in the event of a collision. Seat belts may sometimes present safety hazards, such as when the shoulder belt interferes with exit from the back seat, when the shoulder belt loosens, or when the belt gets caught in the door; in the last case, the webbing may become torn or frayed, or the latchplate may bend, preventing proper engagement with the buckle. The analysis revealed that most seatbelt components are not sold as regular automotive stock items by the automobile dealer, and that in most cases, in order to replace a damaged seatbelt component, one must purchase an entire new seat belt at a discouragingly high price, and must wait several weeks for the order to arrive.

by Lynn L. Bradford; George D. C. Chiang; Mark Meadows
National Hwy. Traffic Safety Administration, Office of Defects Investigation, 400 Seventh St., S.W., Washington, D.C. 20590
Rept. No. NHTSA-TR-ODI-78-01; 1978; 62p 11refs
Availability: NTIS

HS-803 577

55 MPH FACT BOOK [1978 ED.]

Information and statistical data relevant to the effects of the 55 mph maximum speed limit (imposed in 1974) on U.S. traffic are presented. The effects of the speed limit are discussed under the following subject headings: why we have a national maximum speed limit, why 55 mph was selected, results of the 55 mph limit, safety benefits, what happens in a collision, energy savings, truck traffic, truck fuel economy, mileage guidelines for trucks, state enforcement of the 55 mph speed limit, enforcement activity, and public support of 55 mph. Highway speeds increased in 1977, despite the 55 mph speed limit. Although average speeds have not yet reached the levels that existed before the 55 mph limit was imposed, the increase marks a trend toward higher speed, and has been accompanied by increases in fatalities, injuries, and property losses. Appended are statistical data on motor vehicle registration, Part 392--Driving of Motor Vehicles Notice of Policy Statement, and state-by-state summary of penalties assessed for violation of 55 mph speed limit.

National Hwy. Traffic Safety Administration, Enforcement and Emergency Services Div., Washington, D.C. 20590
1978; 38p refs
Availability: Corporate author

HS-803 578

PASSENGER VEHICLE TIRE INSPECTION EQUIPMENT DEVELOPMENT. VOL. 1: SUMMARY REPORT. FINAL REPORT

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DOT-HS-5-01066
Rept. No. SRI-02-4161; 1978; 26p 5refs
Rept. for Dec 1974-Oct 1977. For abstract, see HS-803 579.
Availability: NTIS

HS-803 579

PASSENGER VEHICLE TIRE INSPECTION EQUIPMENT DEVELOPMENT. VOL. 2: TECHNICAL REPORT. FINAL REPORT

Nondestructive tire testing techniques have been developed and the resultant technology enhancement incorporated into a prototype machine capable of performing on-vehicle tests of passenger vehicle tires with respect to three parameters: carcass integrity, inflation pressure, and tread depth. Carcass integrity determinations are made by exciting the tire with a random forcing function (bandwidth 100-400 Hz) and measuring the sidewall response as the tire rotates between displacement

transducers. The random noise concept is shown to be superior to using a sinusoidal forcing function at a particular frequency. A temperature and pressure compensating inflation pressure control device was developed, consisting of an instrumented chuck and a control system capable of calculating the equivalent tire pressure at 72 degrees F, comparing it to a preset value, and adjusting the tire pressure as necessary to the set cold pressure point. A passover tread depth device was also produced, basically a feeler gauge, with 400 probes over a 10-in distance which extend to engage the tire as it passes over the head plate. The travel of the probe results in a change in capacitance, and a processing circuit calculates a tread profile for each tire. Diagrams, charts and photographs for this prototype inspection machine intended for use in an automated vehicle inspection facility are included. It is concluded from the program that tires do not exhibit symmetrical vibratory response; that assymmetry is not a restrictive criterion for successful implementation of the impedance technique; that wideband (100-400 Hz) random force ce excitation methodology should be employed for high-volume inspection of on-vehicle tires; that a carcass flaw rejection criterion needs development; that it is feasible to produce a temperature and pressure compensating inflation pressure control device and a capacitance sensing passover tread depth device; and that a successful prototype passenger vehicle tire inspection machine has been developed. It is recommended that the prototype machine be recycled through a refinement phase, and that controls be upgraded to reflect the gains possible through microprocessor applications.

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DOT-HS-5-01066
Rept. No. SRI-02-4161; 1978; 100p 11refs
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Availability: NTIS

HS-803 581

CITIZEN'S BAND RADIO HIGHWAY SAFETY EVALUATION PROJECT. VOL. 1: TECHNICAL SUMMARY. FINAL REPORT

To measure the effectiveness of Citizens's Band (CB) radio use by New York State Police as a means of improving highway safety, parameters were measured to determine differences between state police use and non-use of CB radios. These included response time of emergency services; number of reports/detections of motor vehicle accidents, selected unsafe driving actions, and violations; number of reports/detections of unsafe driving conditions; number of services provided by CB (e.g. road directions, weather conditions); number of reports received by CB on conditions leading to traffic delays; number of contacts established with the motoring public through CB radio; and number of reports received by CB on criminal acts in process or completed. The results show that state police use of CB radio improves response time to requests for assistance, increases the number of reports on unsafe driving acts and conditions, increases public and state police participation in reporting and responding to highway safety-related incidents, and provides for a public/state police interface. Results obtained from a public opinion poll indicate a high level of public acceptance for state police CB use. Results from a state trooper opinion poll indicate a high level of trooper acceptance of CB radios and agreement among troopers that CB radio use helps. Recommendations include the following: formal recognition by the Federal Communications Commission (FCC) that the CB is a beneficial tool for highway safety, and development by the FCC of special rules to accommodate CB use in the highway safety system; provision of the FCC with those requirements for a citizen/public safety communications interface which will improve responsiveness and effectiveness of highway safety system; establishment of programs for public education on the identification and reporting of emergencies by all means of communication, particularly by CB radio; establishment by the Federal government of a program to develop and enhance greater cooperation among public service, public safety, private industry, and volunteer groups in organizing an effective emergency reporting system centered on motorist-aid radio system; establishment by the Federal government of a program for developing the characteristics of an improved two-way in-vehicle system for motorist aid; permission for public safety base stations equipped with CB to monitor other than emergency channel only if radio set has emergency channel monitor with automatic lock-on; provision of every base station with direct communication access to most appropriate agency; encouragement of improved police coverage of CB; public service information broadcasts on weather and road conditions on a limited basis over CB; permission for public safety and service organizations to install CB radio antennas at heights exceeding present ones; and permission for these organizations to use transmitter powers exceeding present 4 watts.

by N. F. Giangualano; K. S. Crounse; R. G. McPhail; H. F. DeFrancesco
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DOT-HS-6-01436
1977; 63p 1ref
Rept. for Jul 1976-Oct 1977. Subcontracted to Advanced Technology Systems, Inc.
Availability: NTIS

HS-803 582

THE GENERAL DETERRENCE OF DRIVING WHILE INTOXICATED. VOL. 1: SYSTEM ANALYSIS AND COMPUTER-BASED SIMULATION. FINAL REPORT

A system analysis of the general deterrence of driving while intoxicated (DWI) identified system elements relevant to the DWI decision and assessed the potential of countermeasures that might be employed in general deterrence programs. System elements were interrelated in a system model, and potential countermeasures were examined by means of a computer-based simulation based on the model. The simulation program, DETER, employed fixed-time step simulation in which the processing of events, within a time step, was based on an expected value Poisson flow model. Simulation experiments assessed the sensitivity of system parameters and evaluated alternative countermeasure approaches. The system analysis and system model development were based on existing data. Therefore, although system elements relevant to DWI general deterrence could be identified with confidence, many of the interrelationships among elements could not. There are many knowledge gaps, and much data to be collected and analyzed before these gaps will be bridged; but a primary value of completing the system analysis at this time was to identify requirements for additional data and to define the nature of needed research. It is concluded that any significant

reduction of DWI trips or related accidents must be affected through general rather than special deterrence. DWI general deterrence depends critically upon drivers' perceived risk of DWI trips and on the risk aversion characteristics of potential drinking drivers. Relatively small changes in perceived enforcement are likely to produce large changes in number of DWI trips or related accidents. Word-of-mouth feedback from apprehended or sanctioned drivers is not likely to result in any significant reduction in DWI trips or related accidents. Increased visibility of enforcement may reduce DWI trips or related accidents only when combined with factors that increase perceived enforcement when the drivers are exposed. The greatest potential for reduced DWI trips or related accidents is through widespread dissemination of information emanating from effective and consistent DWI enforcement and adjudication action. Research is needed in the areas of perceived risk of enforcement, sanction awareness, utility of DWI, nature and degree of risk aversion, increased visibility of DWI enforcement, effectiveness of public information messages, message exposure techniques, and overall effectiveness of DWI general deterrence.

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DOT-HS-6-01456
Rept. No. 317-2; 1978; 140p 83refs
Rept. for Aug 1966-Oct 1977. Vol. 2, Subsystem Analyses, is HS-803 583.
Availability: NTIS

HS-803 583

THE GENERAL DETERRENCE OF DRIVING WHILE INTOXICATED. VOL. 2: SUBSYSTEM ANALYSES. FINAL REPORT

An analysis was made of subsystems which potentially influence the DWI (driving while intoxicated) decision in an effort to describe these subsystems in terms of functional flow and tasks performed; define existing procedures used by different jurisdictions; identify alternatives to existing procedures which might increase the general deterrence of DWI; and specify research priorities relative to the development and evaluation of procedural alternatives. Typical patrol deployment, arrest, and adjudication subsystems were defined from analyses of the procedures employed in a sample of 25 jurisdictions. Information from secondary sources was available for a sample of 22 jurisdictions which had participated in Alcohol Safety Action Projects (ASAP's); these data were supplemented with surveys of three non-ASAP jurisdictions (rural areas of New Jersey; Santa Ana, Calif. (with an ongoing DWI enforcement program); and Tacoma, Wash. (with no special emphasis on DWI enforcement)). The public information subsystem was defined mainly from secondary sources which presented commercial promotional strategy and communications theory. Four main types of descriptions were prepared for each subsystem: a flow diagram of the primary subsystem functions and interrelationships; a detailed functional sequence diagram showing how the typical subsystem operates; a task sequence list showing, for each task, the information needed, the decision involved, and the alternative actions to be taken; and a listing of procedural alternatives employed in the 25 different jurisdictions. These descriptions were then used to explore subsystem changes that might lead to greater general deterrence of DWI. Based on the analyses completed, research on and development of the following subsystem alternatives are likely to have the greatest long-term payoff: patrol deployment (selective enforcement, patrol strategies, patrol conspicuity), arrest (DWI detection procedures and skills, pre-arrest breath testing, evidential field testing), adjudication (administrative adjudication, trial procedures (e.g. trial only by judge, use of judicial notice for evidential testing, modifications of court scheduling, procedures to eliminate plea bargaining)), and public information (subsystem design, exposure rate and message content).

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DOT-HS-6-01456
Rept. No. 317-3; 1978; 73p 10refs
Rept. for Dec 1977-Apr 1978. Vol. 1, System Analysis and Computer-Based Simulation, is HS-803 582.
Availability: NTIS

HS-803 593

THE HITCH CASE--SAVING AMPOULES FOR A DEFENDANT FROM A CHEMICAL TEST FOR ALCOHOLIC INTOXICATION. FINAL REPORT

A review of the People vs. Hitch case, as decided by the California Supreme Court in 1974, and its subsequent impact in the field of chemical tests for alcoholic intoxication, is presented. The defendant in this case was arrested for driving a motor vehicle while under the influence of alcohol. Under California's implied consent law, he chose to submit to a test of his breath and the officer administered a Breathalyzer test. After the test, the officer discarded the contents of the test ampoule into a glass bottle and threw away the ampoule. The glass bottle was then delivered to the crime laboratory according to established policy. The contents were eventually disposed of by the lab. Prior to trial, the defendant moved to suppress the results of the breath test on the grounds that the destruction of the test ampoule and its contents deprived him of due process of law. The California Supreme Court held that chemicals and ampoules used in breath test cases must be preserved for possible pre-trial examination and analysis by defendants should they so demand it. The scientific basis for the Hitch decision, and appellate court decisions since Hitch in the states of Alaska, Arizona, Colorado, Illinois, Michigan, New Hampshire, New Jersey, Ohio, Oklahoma, Oregon, and Washington, are reviewed. From a review of these cases, it is evident that there is a significant lack of agreement among members of the scientific community concerning what can be learned from saving the test ampoule and its contents used in administering a Breathalyzer test for alcoholic intoxication; doubt is raised about the validity of the Hitch decision. Only Alaska follows Hitch on all points. Several courts (New Jersey, Michigan, New Hampshire, Ohio, Oklahoma (both state and Federal courts)) rejected the ruling in Hitch. The majority of these decisions were based on the failure of the defendant to make a showing by expert testimony that anything of value could be learned from a later testing of the test ampoule or its contents. Two decisions, People vs. Hedrick and People vs. Miller, rejected attempts to extend the Hitch holding to the saving of the breath sample itself rather than the ampoule and its contents.

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DOT-HS-4-00965
1977; 34p refs
Availability: NTIS

HS-803 594

VEHICLE INTEGRATION AND EVALUATION OF ADVANCED RESTRAINT SYSTEMS. VOL. 3: PHASE C. THE EVALUATION OF 1975 TORINO TYPE 2 BELT RESTRAINT SYSTEMS WITH WEB LOCKING AND FORCE LIMITING FEATURES. FINAL REPORT

In the third phase of a series of 18 full-scale car crash tests to evaluate the performance of restraint systems in terms of meeting the Federal Motor Vehicle Safety Standard No. 208 injury criteria, Ford Torinos were tested using instrumented dummies restrained by both standard and modified belt systems (standard 3-point belt system, standard 3-point belt system with web lockers, standard 3-point belt system with web lockers and force limiters, and standard 3-point belt system with web lockers and tear webbing). With the exception of a mounting bracket on the B-pillar for the web locking mechanism, the Torinos were not modified in any manner. The matrix of test conditions (impact conditions and restraint configurations), and data summary (dummy position, restraint system, head (peak G, HIC (Head Injury Criterion)), chest (peak G, CSI (Chest Severity Index), and velocity change) are tabulated. Summaries of vehicle data, injury criteria, restraint system data, and occupant response data are tabulated for each of the nine tests. Vehicle accelerometer locations and coordinates are denoted for each test. Plotted data from each test are presented, and photos showing the before and after conditions of the vehicles and restraint systems are provided. The tests involved collisions with 1976 Volvo 244's.

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DOT-HS-6-01307
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HS-803 601

IMPROVED VISIBILITY FOR SCHOOL BUSES DURING ADVERSE WEATHER. VOL. 1. FINAL REPORT

A program was undertaken to develop realistic performance requirements and compliance test procedures which could be used by school bus manufacturers as well as testing agencies to assure that school bus defogging equipment will meet vehicle driver's visual requirements for forward, sideward, and rearward views under conditions of fog formation on the interior surfaces of the vehicle's glazing during adverse weather. The report defines the problem of school bus fogging during adverse weather and states the objectives of the program, describes the methodology followed, highlights the results and presents conclusions and recommendations. Several buses, including Type I (large), Type II (small), and intra-city transit buses, were tested utilizing normal engine operation and with an auxiliary hot water system. In general, the defogging systems did not perform well, except for the transit bus air conditioning system in the summer test condition. The extremely poor results for one Type II school bus emphasize the need for defogging performance requirements for school buses, to supplement existing defrosting standards. Currently Federal Motor Vehicle Safety Standard 103 (Windshield Defrosting and Defogging Systems) combines defrosting and defogging under one general standard. Results of these tests were used in preparing five detailed test procedures covering the following activities: environmental chamber preparation procedure, bus preparation procedure, detailed test procedure for condition I (winter, 40 degrees F), detailed test procedure for condition II (hot, humid summer), and analysis and evaluation procedure. Several items have not been established in sufficient detail and need further work before a final compliance procedure could be promulgated; these items involve establishing side critical areas, chamber humidity control, repeatability, and sensitivity.

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DOT-HS-6-01398
Rept. No. 8305-77-75A; 1978; 218p
Rept. for Jun 1976-Jun 1978. Vol. 2, Appendixes, is HS-803 602; for summary report, see HS-803 603.
Availability: NTIS

HS-803 602

IMPROVED VISIBILITY FOR SCHOOL BUSES DURING ADVERSE WEATHER. VOL. 2: APPENDIXES. FINAL REPORT

Test procedures for evaluating the performance of school bus defogging equipment, and summaries of results and sequences of defogging photographs for some of the tests which were conducted in the development of the test procedures are presented. Several buses, including Type I (large), Type II (small), and intra-city transit buses, were tested utilizing normal engine operation and with an auxiliary hot water system. Five detailed procedures prepared cover the following activities: environmental chamber preparation procedure, bus preparation procedure, detailed test procedure for condition I (winter 40 degrees F), detailed test procedure for condition II (hot, humid summer), and analysis and evaluation procedure.

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DOT-HS-6-01398
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Availability: NTIS

HS-803 603

IMPROVED VISIBILITY FOR SCHOOL BUSES DURING ADVERSE WEATHER. SUMMARY REPORT. FINAL REPORT

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DOT-HS-6-01398
Rept. No. 8305-78-104; 1978; 29p 18refs
Rept. for Jun 1976-Jun 1978. For abstract, see Vol. 1, HS-803 601. Vol. 2, Appendixes, is HS-803 602.
Availability: NTIS

HS-803 607

RSV [RESEARCH SAFETY VEHICLE] PHASE 3. BIMONTHLY PROGRESS REPORT NO. 9, JUNE-JULY 1978

The progress made on the Research Safety Vehicle (RSV) Phase 3 program is organized into task sections, detailed to the subtask level. Subcontractor progress reports are included as appendices. Under Task 4, in Jun and Jul a number of modifications to subcontracts and requests for additional proposals for subcontractors were made, including proposals for an antiskid braking system and a series of pedestrian impact simulations. Under Task 5.1, Product Improvement of Inflatable Restraints, two RSV driver restraint system sled tests were conducted to demonstrate that the final restraint system is capable of providing protection for the 50th percentile male dummy in a 50 mph sled test. The driver seat was subjected to two 50 mph driver restraint sled tests and six 50 mph passenger sled tests. A test of adhesives for the head restraint was conducted; a lighter, more production-oriented column support bracket and a pedal assembly bracket were designed. Six sled tests were run on the passenger air cushion restraint system, to determine effects of the design changes (eliminating the stroking dash and using a production seat) made on the Phase 2 system. Under Task 5.3a, Structural Refinement, a major effort will be to complete and correct the structural drawings for the Build 5 design, due for completion by Oct 1979. Also included are weight control and reductions, and systems refinement and production engineering (engine and rear suspension, front suspension and steering; gear shift; control pedal assembly; parking brake; electrical; heater/ventilation; passenger restraints; dash; steering column and airbag; door latches, locks and controls; front body glove; door hardware; center spine cover; driver/passenger seats and body glazing). Under plastic material improvement (Task 5.4) the basic 10 mph no-damage bumper is ready for forming and the first article is expected in mid-Sep. An effort to redesign the bumper to meet additional criteria has been started. The tooling aids for the front and rear fenders and rear fascia are being completed, with delivery expected in Jan 1979. The computer simulation model (Task 5.10) developed over the past months was correlated with Test 6.7 with excellent results. Discussions on high technology engine/transmission (Task 5.13) centered on technical interfaces; computer-vehicle interfacing should start in Aug. New actuator designs were started; the pneumatic shifter was also tested. Under Task 5.14a body-in-white fabrication has continued; all first article and tool inspections have been completed and vendors authorized to complete production. Systems fabrication (Task 5.14b) has continued with emphasis on integration of the restraint systems. Progress of Kinetic's accident/benefit analysis (Task 5.16) is summarized in an appendix, as is Volvo's progress on the advanced engine (Task 5.17d). Costs and schedules were reviewed for the production of the seven vehicles in Phase 3a, and it was concluded that present funding will be adequate.

Minicars, Inc., 55 Depot Rd., Goleta, Calif. 93017
DOT-HS-7-01552
Rept. No. PR-Jun/Jul-78; 1978; 217p refs
Cover title: Progress Report. RSV Phase III
Availability: Reference copy only

HS-803 610

ACCIDENTS INVOLVING HANDICAPPED DRIVERS. FINAL REPORT

Accidents involving handicapped drivers and those involving non-handicapped drivers in New York State from 1974 through 23 Aug 1977, are compared. The study group is composed of 2841 handicapped drivers who require full hand controls because of a disability of both feet or legs due either to missing limbs or limb immobility. The control group is composed of randomly selected non-handicapped drivers from the New York State Master Driver License File. Findings from this analysis, primarily statistical in nature, are intended to help identify and highlight areas which may warrant action on the part of motor vehicle administrators. The data show that the handicapped group of drivers do have a higher accident rate than the non-handicapped group. Also, accidents involving the study group differ significantly from those involving the control group by several accident variables such as weather conditions, road system, and accident type. Several follow-up studies became apparent. It is reasonable to believe that there are differences in the performance of the various mechanical assistance devices in use. Therefore, it is recommended that further research be conducted using these and additional data, controlling for the specific type of mechanical assistance device used. It is possible that there is a different population mix of handicapped drivers geographically, i.e. handicapped drivers may tend to live and drive more in congested urban areas because of the facilities and job opportunities offered in these locales. A study should determine if there are significant differences in area of residence between handicapped and other drivers, which would provide information to show if the higher accident rate of handicapped drivers is the result of exposure to greater traffic volumes. It is possible that there are two distinct groups of handicapped drivers, those born with or living most of their lives with their handicap, and those who through injury or sickness acquired their handicap later in life. It may be desirable to conduct a study comparing accident data for these two groups. An appended report prepared by John Carson and Richard Ibison of the National Hwy. Traffic Safety Administration (NHTSA) provides a brief history of research in support of rulemaking on hand controls sponsored by NHTSA. Form MV-144A (Summary of Motor Vehicle Accidents) summaries of the accidents involving the control and study group drivers, by age and sex, are also appended.

by D. Barry Negri
New York State Dept. of Motor Vehicles, Div. of Res.,
Empire State Plaza, Albany, N.Y. 12228
DOT-HS-4-00936
1978; 101p 4refs
Rept. for Dec 1976-Mar 1978.
Availability: NTIS

HS-803 613

AN ANALYSIS OF FATALITIES IN CARS EQUIPPED WITH AIR BAGS

The data employed in an earlier analysis of air bag field experience are updated to 1 Sep 1978; more realistic and accurate methodology is employed to derive a comparison fatality rate for vehicles not equipped with air bags, but in other respects identical to the production air bag vehicle fleet. Results show that, with proper computation of the effectiveness of air bag systems based on the experience of the General Motors cars equipped with the Air Cushion Restraint

System (ACRS), the value obtained is completely consistent with the Dept. of Transportation's earlier estimates of air bag effectiveness: 45% with lap belt usage of around 15% in the air bag cars (effectiveness defined as the reduction in fatalities compared with the number of fatalities that would have occurred if all vehicle occupants were unrestrained.) The results are not changed substantially if the cars equipped with air bags prior to the introduction of the ACRS as a regular production option on some General Motors' 1974-1976 cars are included in the analysis. Large uncertainties are involved in calculating the effectiveness of airbags using the limited data available. Slightly more than 12,000 automobiles equipped with air bags have operated on U.S. roads since 1971. Of these, 10,281 were built on regular assembly lines with air bags as a regular production option, and were sold primarily to the public, the remainder to government and business fleets. Air bag cars have traveled more than 600 million miles, and there have been more than 200 known air bag deployments in crashes, with five fatalities.

National Hwy. Traffic Safety Administration, Washington, D.C. 20590
1978; 12p 4refs
Availability: Reference copy only

HS-803 614

PAST, PRESENT AND FUTURE SAFETY BENEFIT ASSESSMENT METHODS

A review is made of the safety benefit assessment methods for Federal Motor Vehicle Safety Standard 208, Occupant Crash Protection, as they were developed according to the types and amounts of information available in each successive phase of the program. It documents the methodology used during the experimental system phase climaxing with the passive system amendment of 30 Jun 1977. The influx of extensive new data is recognized, as the program enters its implementation phase, and the corresponding changes to the methodology which are anticipated are discussed, as well as future applications. Appendix A documents the assessment methodology, the input and output data in full detail. Appendix B consists of an excerpt from the Federal Register regarding the effectiveness of passive restraints (42 FR 34292-3). Appendix C details the analysis that led to the benefits and cost information presented in Section IV of the Secretary of Transportation's decision of 6 Dec 1976. A discussion of the effectiveness of occupant crash protection systems is contained in Appendix D, and there is a review of the total national highway safety problem quantifying those major elements attributed to deaths and injuries of passenger car occupants (particularly drivers and front seat passengers) in Appendix E.

by Conrad H. Cooke
National Hwy. Traffic Safety Administration, Engineering Systems Staff
1978; 53p 17refs
Availability: Corporate author

HS-803 621

ANALYSIS OF NEW YORK STATE [VOLKSWAGEN] RABBIT TAPE

An analysis is presented of data on all reportable accidents in New York State involving Volkswagen (VW) Rabbits from Jan 1975 to Jun 1977. The distribution of injuries by body region was not significantly different for drivers and right-front seat occupants of passive belt system (PBS) vs. active belt system (ABS) Rabbits. There were no reported knee fractures for drivers and right-front seat passengers in the PBS Rabbits (these contain a knee bolster). No difference was found in types of crashes involving the two systems. Since New York does not encode uninjured people in property damage accidents, only 46% of the Rabbits have drivers encoded on the tape. By assuming that any Rabbit not listed as parked had a driver in it, an estimation was made of the total number of uninjured drivers in PBS and ABS Rabbits. Of all PBS drivers, 20% were injured, compared with 25% of ABS drivers, a reduction of 21% in all injuries for the PBS over the ABS system. Using standard statistical tests, it can be concluded that the overall driver injury rate is lower in the PBS than in the ABS Rabbits. However, the actual magnitude of this reduction cannot be determined with any precision. Using another assumption for right-front seat passengers provided injury rates of 20% for PBS vs. 23% for ABS right-front occupants. Detailed data used in the analysis are attached.

by Mark Cassidy; Stephen Cohen
National Center for Statistics and Analysis, Mathematical Analysis Div.
1977; 14p
Availability: Reference copy only

HS-803 622

EFFECTS OF VEHICLE-IN-USE SPRING SAG ON VEHICLES HANDLING AND BRAKING

Test results are presented and discussed for an investigation into the influence of sagged coil springs and coil spring spacers on handling performance of two full-sized automobiles, an AMC Matador 1974 and a Ford LTD 1976. An overview presents the technical approach followed, including test vehicle descriptions, spring and spacer configurations employed, test maneuvers, and the measurement system. Findings relate vehicle stability factor and controllability with change in ride height, sprung mass roll axis, and suspension bump-stop bottoming. Under nominal, low lateral acceleration maneuvering and handling situations, uncorrected sagged springs can lead to a significant decrease in vehicle understeer; the use of spring spacers to restore vehicle ride height tends to return the vehicle toward its original understeer characteristic; minor differences in the spacer effectiveness may be related to basic design and material; the range of stability factors obtained for the extreme of configurations tested (original equipment vs. all springs sagged and no spacers) is about the same as might be induced by changing the front/rear tire inflation differential from 8 psi to 2 psi or from exchanging new tires for worn. The range of stability factors obtained over all configurations tested is well within the vehicle-to-vehicle variability observed between domestic vehicle makes and models. Under high lateral acceleration testing typical of emergency maneuvers, asymmetric sagged spring and spacer usage results in different handling in left vs. right maneuvering and can lead to vehicle controllability problems; sagged springs either with or without spacers are prone to bottoming so there is direct contact between the sprung mass (body) and the suspension components; suspension bottoming produces a sudden shift in effective center of rotation for body roll, a sudden change in tire side-to-side vertical load differential, and consequently a sudden decrease in stability factor, noticeable to the driver and possibly leading to controllability problems. Sagged springs with or without spacers produced no noticeable change

in handling or response from that of the original equipment vehicle in the brake in turn and bump in turn maneuvers.

by Stephen H. Schwartz; Donald E. Johnston
Systems Technology, Inc., 13766 S. Hawthorne Blvd., Hawthorne, Calif. 90250
DOT-HS-7-01799
Rept. No. WP-1119-3; 1978; 42p 5refs
Availability: Corporate author

HS-803 625

DRIVER VISIBILITY QUALITY: AN ELECTRO-OPTICAL METER FOR IN-VEHICLE MEASUREMENT OF MODULATION TRANSFER (MTF). FINAL REPORT

In order to provide a practical means for developing and monitoring standards of driver visibility quality, an electro-optical MTF (modulation transfer) meter, the NHTSA (National Hwy. Traffic Safety Administration) Visibility Quality Meter (VQM), was developed. Tests were conducted with Landolt ring targets to relate human vision to meter readings, under various types of optical degradation (windshield fogging, icing, dirt film, etc.); there was excellent agreement between meter readings and visual test measures, confirming that the VQM can stand in as an "average observer" to determine if visibility quality meets minimum requirements. The VQM is a rugged and simple solid-state device with an oscilloscope display of image luminance cross section; image contrast values are read directly from the display for determination of MTF (i.e. contrast transmittance). The large body of visual contrast-sensitivity data available in the literature can be related directly to VQM readings, thus providing visibility standards for targets of a given size, shape, distance, luminance, and viewing condition. Further research with driving-specific visual tasks is required, however, to directly link the VQM and driver visibility requirements. This project has demonstrated that a relatively simple optical meter can be used for in-vehicle measurement of contrast degradation and optical distortion. Since the MTF's in question are decreasing monotonic functions of spatial frequency, it is sufficient to test at just one spatial frequency representing finer detail to ensure adequate visibility for all detail larger than the test frequency; this makes compliance testing procedures very straightforward. It has been found that driver visibility is limited more often by contrast degradation than by inadequate resolution, since many of the driver's visual tasks involve relatively very large objects. The MTF for veiling luminance is equal at all frequencies, permitting very simple measurement. Appendices contain the alignment procedure, some aids to calculation and useful conversions.

by John O. Merritt; Robert E. Newton; Glenn A. Sanderson; Merlyn L. Seltzer
Human Factors Res., Inc., 6780 Cortona Drive, Goleta, Calif. 93017
DOT-HS-6-01426
Rept. No. PB-281 894; TR-1780-1; 1978; 165p 41refs
Rept. for Jun 1976-Apr 1978.
Availability: Corporate author

HS-803 686

ANALYSIS OF FORD MOTOR COMPANY REPORT ON THE STATE OF THE U.S. AUTOMOTIVE INDUSTRY

The statements and recommendations offered by Ford Motor Co. in its Jun 1978 report entitled "State of the U.S. Automotive Industry," are addressed by the National Hwy. Traffic Safety Administration (NHTSA) in view of the fact that most of Ford's statements pertain to items under NHTSA jurisdiction. A summary of Ford's recommendations and NHTSA's reactions to them is followed by a page-by-page analysis of the Ford document. Not all pages are covered as some, particularly those discussing auto emissions, are best responded to by others; and several pages are grouped because of their consistent theme. The Ford report shows the company's concern over what it perceives to be the state of the U.S. auto industry today and how that pertains to the possible impact of regulation in the early 1980's. Ford desires to make the government more sensitive to the financial demands being placed on the company from the rulemaking activities of many government agencies. Ford is especially concerned that the fuel economy standards will place a large financial burden on the company. Ford's specific recommendations include the following: appreciation by all government agencies of the cumulative effect of each other's regulations; a slowdown or halt in new regulations; review of all standards taking effect beyond model year 1979 by the President's Regulatory Analysis Review Group; preparation of a regulatory budget; no raising of the 1985 fuel economy standard above 27.5 mpg; reexamination of the 1981-1983 fuel economy standards because they require large capital expenditures with little fuel savings to show for them; reasonable and expeditiously-issued model year 1982-1984 truck fuel economy standards; and revision of the Clean Air Act to lower 1981-1982 emission standards for carbon monoxide to 7 g/mi. NHTSA agrees that government agencies must look beyond the impact of single regulations and consider the industry resources required for compliance with other standards; disagrees with the idea that new or amended regulations not be issued; is currently analyzing the ability of manufacturers to meet fuel economy standards above 27.5 mpg; is not considering revising downward 1981-1983 standards; and is concerned over the lead time for truck fuel economy rulemaking.

National Hwy. Traffic Safety Administration, Office of Plans and Programs, Washington, D.C. 20590
1978; 47p 13refs
Availability: Corporate author

HS-810 333

REMARKS AT THE ANNUAL CONFERENCE OF THE AMERICAN ASSOCIATION OF MOTOR VEHICLE ADMINISTRATORS (46TH), SAN DIEGO, CALIFORNIA, SEPTEMBER 14, 1978

Several of the most important common goals of the National Hwy. Traffic Safety Administration (NHTSA) and the American Association of Motor Vehicle Administrators (AAMVA), their respective viewpoints and roles, and some of NHTSA's ongoing related activities and their relationship to AAMVA and its members are addressed. One mutual goal is the establishment of a standardized vehicle identification number (VIN) system. On 11 Aug 1978, NHTSA issued the final rule for a standardized VIN which embodies most of the substan-

tive features of the VESC (Vehicle Equipment Safety Commission) system which have been advocated by AAMVA; however, the AAMVA remains dissatisfied with the result, with many members continuing to believe that NHTSA does not understand adequately or appreciate what the motor vehicle administrator needs in a VIN system. It is hoped that further discussions will result in a mutually satisfactory solution for NHTSA, AAMVA, and VESC. A second major NHTSA goal of great interest to motor vehicle administrators is the improvement of service by the National Driver Register (NDR). NHTSA is currently working to get the NDR operating on a real-time basis with direct computer access by all 50 states. The major areas of concern relate to the performance of the automated record-matching algorithms, and whether states will be able to develop software and acquire hardware for the system. Another NHTSA program priority of considerable interest to the motor vehicle administrator is the Nonresident Violator Compact; NHTSA is cooperating with AAMVA in joint efforts to foster greater participation in this Compact. NHTSA is exploring and developing the concept of administrative adjudication of certain traffic offenses. With respect to motor vehicle inspection and vehicle safety defects, NHTSA would like to work with state officials to assure that state air quality control plans (as required by the Environmental Protection Agency) take full advantage of opportunities to integrate safety and emissions inspection functions. NHTSA would like to explore further with motor vehicle administrators the possibility of cooperative efforts to improve owner response to vehicle safety defect recall campaigns. For the past year, NHTSA has been working with AAMVA to establish guidelines in driver identification and license security to meet the problem of false identification in driver licensing, and NHTSA has developed a short training program for driver license examiners to assist in recognizing false documents. With respect to traffic records systems, NHTSA continues to support the AAMVA-sponsored "ANSI D-20 States' Model Motorist Data Base Committee". However, much more needs to be done in this area, and NHTSA has undertaken a concerted effort to upgrade the content and quality of accident data in each state.

by Howard Dugoff
National Hwy. Traffic Safety Administration, Washington, D.C. 20590
1978; 8p
Availability: Corporate author

HS-810 334

REMARKS BEFORE THE NATIONAL CONFERENCE OF EDITORIAL WRITERS, DETROIT, MICHIGAN, OCTOBER 19, 1978

The questions of whether automotive regulation is needed and of whether present and planned Federal regulatory programs affecting motor vehicles meet that need are addressed. Manufacturers in recent times have acknowledged that safety, emissions, and fuel economy regulation is the most sensible and orderly way for them to meet the public demands to advance these socially desirable goals. Manufacturers, however, have shown little inclination to police themselves in a number of obvious areas absent in existing regulation (e.g. occupant protection in vans and light trucks, improved comfort and convenience of safety belts in an effort to encourage their use). In spite of the deficiencies, the motor vehicle safety regulatory program has paid off handsomely; it is estimated that in 1974, motor vehicle safety standards alone saved some 28,000 lives. Many more injuries did not occur or were much less serious than they might have been because of the increased safety of cars built since 1968. Looking to future vehicles, the Research Safety Vehicle (RSV) Program has shown what is possible. The Minicars' large RSV is a prototype of the full-size family sedan designed to have even more room than today's equivalent cars, to get up to 27.5 mpg as is required by law as a fleet average in 1985, to protect its passengers in 40-mph frontal crashes and 30-mph side impacts, to achieve statutory emission levels, and to provide improved pedestrian protection. Besides assuring the production of vehicles that are safe, fuel-efficient, clean-burning, and damage-resistant, the Federal Motor Vehicle Safety Standards have increased the competitive position of U.S.-made cars in the domestic market, spurred the development of many new industries, and contributed to the long-term control of inflation by curbing economic expenditure that makes no contribution to the country's social and economic well-being. It is estimated that the average price to consumers of safety features contained in a model year 1978 automobile is about $250. As a frame of reference, the average new car purchaser spends 3 to 4 times this amount for comfort and convenience options such as air conditioners and vinyl roofs. Safety features constitute only about 5% of the average vehicle price. A recent survey showed that the public, by an overwhelming margin, believes that auto makers need at least "quite a bit" of regulation. By a two-to-one margin, the survey found that Americans believe that the government should require automatic crash protection in new cars rather than encourage greater safety belt use. Half of the respondents said that they thought that the auto makers could do a better job of improving gas mileage without increasing costs.

by Joan Claybrook
National Hwy. Traffic Safety Administration, Washington, D.C. 20590
1978; 15p 2refs
Availability: Corporate author

HS-810 335

REMARKS BEFORE THE ANNUAL CONFERENCE OF GOVERNORS' HIGHWAY SAFETY REPRESENTATIVES, LAKE TAHOE, NEVADA, OCTOBER 23, 1978

Involvement of the public sector in state and community highway safety programs is addressed. Highway safety programs particularly are designed to serve public needs, and the likelihood of their success, whether in terms of political acceptance at the state legislative level or acceptance among the public at large, is vitally dependent on active citizen involvement. There is a growing effort by the public to make government more accessible, accountable, and responsive. The issue is whether the government works for the people. It is necessary to find ways to ensure that traffic safety programs are based on the real concerns of the people. Six possibilities are offered for channeling the energy of public-spirited people to increase highway safety. First, efforts should be made to let people know who is getting killed, not just how many people are killed (human aspects vs. statistics). Second, others who care, such as those whose personal lives have been touched by a traffic accident, should be identified and encouraged to become involved in highway safety activities. Third, better communications should be developed with the professionals in the field who work each day with people who have been seriously harmed in auto crashes, i.e. the physical therapists, vo-

cational rehabilitation people, the orthopedic surgeons, the paraplegic, epileptic, and other disability organizations. The PTA's and other groups concerned with children also need to be informed of critical issues in highway safety. Fourth, the involvement of citizens in problem identification and planning processes should be expanded (expanding state contracting activities with nonprofit organizations at the grass roots level). Fifth, governments should become earnest students of the theories and techniques of citizen participation, and sixth, more public panels could be formed, like the ones in California and Oregon.

by Joan Claybrook
National Hwy. Traffic Safety Administration, Washington, D.C. 20590
1978; 13p
Availability: Corporate author

HS-810 336

STATEMENT BEFORE THE SUBCOMMITTEE ON GOVERNMENTAL EFFICIENCY AND THE DISTRICT OF COLUMBIA, SENATE COMMITTEE ON GOVERNMENTAL AFFAIRS, OCTOBER 31, 1978

The proper role of the government in setting motor vehicle safety standards, what the Ninth Circuit Court of Appeals decision says about that role, the National Hwy. Traffic Safety Administration's (NHTSA) most recent findings about heavy-vehicle performance on the highway, and what NHTSA should do in future proceedings on the air brake standard (Federal Motor Vehicle Safety Standard (FMVSS) No. 121), are addressed. FMVSS 121 has been in effect for trailers since 1 Jan 1975, and for trucks and buses since 1 Mar 1975. The standard provided four years lead time to the industry. Major requirements of the standard are that vehicles stop in specified distances and that the wheels not lock uncontrollably during these stops. A petition for judicial review of the standard has resulted in invalidation of several aspects of the standard, effective 11 Oct 1978; these are the "no lockup" provision as it applies to trucks and trailers, and the related truck stopping distances conducted from 60 mph. NHTSA believes that the philosophy of the court in this respect was that government must be the guarantor of industry's implementation of the standards. While that view of NHTSA's role might be appropriate under other statutes which require certification by the government, the Vehicle Safety Act and legislative history make it clear that the agency neither should nor could be the guarantor of every automotive design. Rather, following issuance of a reasonable and practicable minimum standard, the agency's role is limited to monitoring progress and evaluating the performance of the systems manufactured. Because NHTSA realized that the performance requirements of FMVSS 121 pushed the state of the art to some degree, it undertook substantial monitoring of the standard's progress. Users and a few manufacturers, including those with alternative approaches to vehicle stability, have been concerned with the newness of the antilock system as applied to truck brakes, the need for additional brake maintenance, the expense of these changes, and the comparative unreliability of some early-generation components. A NHTSA task force reported in Feb 1978 that based on warranty reports to manufacturers and continued testing, the reliability and durability of 121 componentry has been increasing. Investigations sponsored by NHTSA into truck accidents where 121 systems were blamed have indicated that the brake system was not the causative factor. Improved reliability has been demonstrated with antilock systems on buses. A study by the Hwy. Safety Res. Inst. on the overall rate of truck accidents involving pre-121 and 121-equipped vehicles was initiated about 2 1/2 years ago; the interim report is being made available for comment by accident statisticians, vehicle handling experts, etc. Unlike most NHTSA standards for trucks or cars, the "no lockup" requirement demands a significant degree of cooperation between manufacturer and user, and a necessary amount of maintenance to keep antilock working properly. Unless the industry is willing and able or required by law to perform that maintenance, such a standard cannot produce its intended benefits.

by Joan Claybrook
National Hwy. Traffic Safety Administration, Washington, D.C. 20590
1978; 15p 4refs
Availability: Corporate author

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Dutcher Industries, Inc., 7617 Convoy Court, San Diego, Calif. 92111
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